Department of the Navy
Base Realignment and Closure Program
Management Office West

FINAL

Remedial Action Completion Report, Durable Cover, Groundwater Treatment, and Institutional Controls for Parcel G, Hunters Point Naval Shipyard, San Francisco, California

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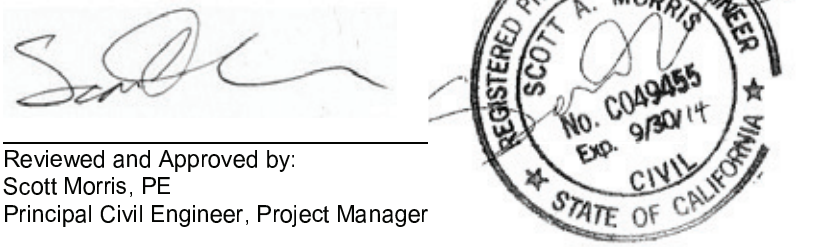

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Prepared for:
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Figures

Appendices

Acronyms and Abbreviations

AB	aggregate base
AC	asphaltic concrete
APP	Accident Prevention Plan
ARCADIS	ARCADIS U.S., Inc.
ARIC	Area Requiring Institutional Controls
BCT	BRAC Cleanup Team
BGMP	basewide groundwater monitoring program
BMP	best management practice
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
CQC	Contractor Quality Control
CSO	Caretaker Site Office
DoD	U.S. Department of Defense
DTSC	Department of Toxic Substances Control
ERRG	Engineering/Remediation Resources Group, Inc.
FFA	Federal Facility Agreement
FS	Feasibility Study
HPNS	Hunters Point Naval Shipyard
IC	institutional control
IR	Installation Restoration
LUC	land use control
msl	mean sea level
Navy	United States Department of the Navy
O&M	operation and maintenance
PAH	polycyclic aromatic hydrocarbon
PAL	project action level
PCE	tetrachloroethene
PPE	personal protective equipment

RA	Remedial Action
RACR	Remedial Action Completion Report
RAO	remedial action objective
RAWP	Remedial Action Work Plan
RG	remedial goal
RD	Remedial Design
ROD	Record of Decision
ROICC	Resident Officer In Charge of Construction
RPM	Remedial Project Manager
SARA	Superfund Amendments and Reauthorization
Sealaska	Sealaska Environmental Services
SHPO	State Historic Preservation Office
SSHP	Site Safety and Health Plan
TCE	trichloroethene
TCRA	time-critical removal action
Tetra Tech	Tetra Tech EC Inc.
USA North	Underground Service Alert of Northern California
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
ZVI	zero-valent iron
µg/L	micrograms per liter

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Executive Summary

In accordance with the Hunters Point Naval Shipyard (HPNS) Parcel G Final Record of Decision (ROD), the final remedy for Parcel G consists of: excavation and off-site disposal, durable covers, and institutional controls (IC) to address soil contamination; treatment of volatile organic compounds (VOCs) with biological substrate or zero-valent iron (ZVI), monitoring, and ICs to address groundwater contamination; and surveying, decontaminating, and removing of radiologically impacted structures and soil (United States Department of the Navy [Navy] 2009).

This Remedial Action Completion Report (RACR) for Durable Cover, Groundwater Treatment, and Institutional Controls, the RACR for Soil Hotspot Locations at Parcels B, D-1, and G and Soil Stockpiles at Parcels D-1 and G (Engineering/Remediation Resources Group, Inc. [ERRG] 2011), and the Radiological RACR (Tetra Tech EC Inc. [Tetra Tech] 2011) document the completion of the remedial actions (RAs) at Parcel G, HPNS, San Francisco, California.

The Final RACR for Soil Hotspot Locations at Parcels B, D-1, and G and Soil Stockpiles at Parcels D-1 and G (ERRG 2011) documents that the remedial action objectives (RAOs) have been met for the excavation and off-site disposal of contaminated soil portion of the final remedy, while the Final Radiological RACR (Tetra Tech 2011) demonstrates the completion of the surveying, decontaminating, and removing of radiologically impacted structures and soil. Accordingly, detailed information on these RAs and descriptions of how those actions met the associated ROD RAOs are not included in this RACR. This RACR describes the RA for the installation and repair of durable covers, including asphalt covers and building foundations, which provide physical barriers to prevent exposure of humans and wildlife to potential remaining chemicals of concern (COCs) in soil. In addition, the technical aspects of the groundwater treatment, which was completed in 2009 (Alliance Compliance Group 2010), subsequent monitoring, and the soil and groundwater IC components of the final remedy are also documented in this RACR in sufficient detail for verification that the RAOs have been met.

The durable cover RA was performed in accordance with the Final Remedial Design Package, Parcel G, Hunters Point Shipyard, San Francisco, California (ChaduxTt 2010a) and the Final Remedial Action Work Plan (RAWP; ARCADIS 2012a). The durable cover construction was implemented between January and July 2013.

The following paragraphs summarize the RA work performed and the actions taken to achieve the RAOs prescribed for Parcel G for the durable cover, groundwater treatment and monitoring, and ICs. The RAOs for soil and groundwater are included in Section 2 of this report.

Institutional Controls

As described in the ROD, the entire area of Parcel G has been included in the area requiring institutional controls (ARIC) for the protection of human health and the environment through land use controls. Specific portions of Parcel G have been included in the ARIC for soil vapors. Institutional controls/land use controls (LUCs) restrict specific uses of the property to limit exposure of future users to hazardous substances and maintain the integrity of the remedies implemented. The Navy has implemented and enforces the LUCs described in the LUC Remedial Design (RD) through restricting site access and limiting site uses. The Navy continues to monitor IC performance and that RAOs are being met through the operation and maintenance (O&M) process and annual inspections as specified in the LUC RD and required in the ROD (ChaduxTt 2010a, Navy 2009).

Soil at Parcel G

The final component of the soil RA summarized in this RACR consists of installation and repair of durable covers, including asphalt covers and building foundations, in accordance with the RAWP (ARCADIS 2012a), to minimize exposure of humans and wildlife to potential COCs in underlying soil.

In accordance with the RD, ROD, and RAWP, a final surface of asphalt pavement was constructed over the exterior/non-building portions of the parcel. Existing asphaltic concrete (AC) covers that had degraded were restored by applying an asphalt seal coat or asphalt overlay. Newly constructed asphalt pavement was applied over the portions of the parcel where the historically present AC was not present at or near the ground surface. Concrete building foundations and concrete pads were also restored and incorporated into the final cover. Cracks in concrete were filled with non-shrink grout. The final surface over the parcel is a fully intact continuous cover that minimizes physical contact and exposure to the underlying soil.

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Radiologically Impacted Sites at Parcel G

The Navy Radiological Affairs Support Office identified radiologically impacted sites, including buildings, equipment, and infrastructure, at Parcel G associated with the former use of general radioactive materials and decontamination of ships used during atomic weapons testing in the South Pacific (Naval Sea Systems Command 2004). The radiological investigation was completed in 2004 and the Navy conducted a time-critical removal action (TCRA) from 2007 through 2011 to address potential radioactive contaminants in buildings, fill areas, former building sites, storm drains, and sanitary sewers at Parcel G (Navy 2006 and Tetra Tech 2011). Additional information on this TCRA is included in the Parcel G RACR for the storm drain, sanitary sewer, building, and former building radiological activities prepared by Tetra Tech in 2011. The cleanup associated with the TCRA for radionuclides met the remedial goals established in the ROD. As a result, all areas on Parcel G have been remediated for radionuclides.

Groundwater at Parcel G

The groundwater remedy, as stated in the HPNS Parcel G ROD (Navy 2009), consists of treatment of VOCs with biological substrate or ZVI, groundwater monitoring, and ICs to address groundwater contamination. The remedy has been completed by means of a treatability study (Alliance Compliance Group 2010), implementation of ICs, and the groundwater monitoring program (CE2-Kleinfelder 2012).

The COCs in groundwater at Parcel G are VOCs and metals (chromium VI and nickel). The Navy conducted a treatability study at Parcel G in 2008 to evaluate technologies to address VOCs and metals in groundwater (Alliance Compliance Group 2010). The study included treatment using ZVI. After the treatability study, concentrations of COCs in groundwater dropped below the remedial goals established in the ROD except for one well in the deeper portion of the upper A-aquifer. The Navy decided, with the concurrence from the Base Realignment and Closure Cleanup Team (BCT), not to continue to treat the deeper portions of the A-aquifer. The risk related to VOCs in groundwater was based on migration to indoor air from the shallow groundwater, and the study concluded that the associated risk to commercial/industrial workers was less than the target risk threshold and that RAOs are being met. Based on the basewide groundwater monitoring program (BGMP) sampling data, concentrations of VOCs exceed remedial goals in the deep upper aquifer; however, groundwater samples from the shallower portion of the aquifer remain below remedial goals confirming that RAOs continue to be met.

The ROD identified a potential risk to saltwater aquatic organisms from concentrations of chromium VI and nickel in groundwater at Parcel G that could discharge into San Francisco Bay (Navy 2009). Nickel and chromium VI were addressed as part of the groundwater treatability study and metals concentrations have been monitored as part of the BGMP. Results from recent samples do not indicate that chromium VI or nickel pose a risk to ecological receptors in the bay, thus, the RAOs are being met. However, semiannual groundwater monitoring will be continued to further evaluate chromium VI concentrations and confirm that RAOs continue to be met.

Soil Gas at Parcel G

The primary COCs in soil gas at Parcel G are VOCs. In 2010 the Navy implemented a focused soil gas survey to identify locations where concentrations of COCs in soil gas may exceed action levels and to evaluate the extent of VOC areas requiring ICs or remediation (ChaduxTt 2010b; Sealaska Environmental Services [Sealaska] 2012). The ROD initially specified all of Parcel G as an ARIC to ensure that the risks of potential exposures to VOC vapors are reduced to acceptable levels that are adequately protective of human health. In accordance with the ROD, soil vapor surveys were conducted after the groundwater cleanup actions for the following purposes: (1) to evaluate potential vapor intrusion risks, (2) to identify COCs for which risk-based numeric action levels for VOCs in soil gas would be established, (3) to identify where the initial ARIC for VOCs would be retained and where they would be released, and (4) to evaluate the need for additional remedial action in order to remove ARICs. The technical memorandum that summarizes the results of the soil gas survey presents changes to the ARIC for VOC vapors and the rationale for the changes (Sealaska 2013). These boundaries of the ARIC for VOC vapors will be incorporated in the documents describing the ICs (Covenant to Restrict Use of Property and Quitclaim Deed). To ensure that risk from potential exposures to VOC vapors is reduced to levels adequately protective of human health, proposed construction activities within the grid blocks designated as ARICs for VOC vapors must be approved in accordance with the LUC RD, Covenant(s) to Restrict Use of the Property, and Quitclaim Deed(s).

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Post-Construction and Ongoing Activities

Following completion of durable cover construction activities, the Navy inspected the RA work performed and certified completed portions of the RA. The remedy is being maintained in accordance with the O&M plan, which describes the procedures to be implemented for monitoring and maintenance of the durable covers installed as part of the remedy. The Navy will perform ongoing maintenance and monitoring in accordance with the O&M plan.

The Navy will also perform periodic (at least annual) compliance monitoring of ICs through the O&M process and inspections. These inspections will be conducted in accordance with the LUC RD (ChaduxTt 2010a). Inspections consist of verification that the site uses remain in compliance with the LUCs. IC compliance will be reported along with the annual O&M compliance monitoring.

Groundwater monitoring conducted under the BGMP is ongoing at Parcel G and will continue to be implemented to verify that RAOs for the groundwater remedies continue to be met (CE2-Kleinfelder 2012).

1. Introduction

ARCADIS U.S., Inc. (ARCADIS) has prepared this Remedial Action Completion Report (RACR) for the United States Department of the Navy (Navy) Base Realignment and Closure (BRAC) Program to document the completion of remedial actions (RAs) to address chemicals of concern (COCs) at Parcel G, Hunters Point Naval Shipyard (HPNS), San Francisco, California. The RACR was prepared in accordance with the U.S. Department of Defense (DoD) and U.S. Environmental Protection Agency (USEPA) Joint Guidance on Streamlined Site Closeout and NPL Deletion Process for DoD Facilities (DoD and USEPA 2006).

The final RA for soil specified in the Final Record of Decision (ROD; Navy 2009) included installation and repair of durable covers, principally asphalt covers and building foundations, which provide physical barriers to prevent exposure of humans and wildlife to potential COCs in soil. This RA was performed in accordance with the "Final Design Basis Report, Parcel G, Hunters Point Shipyard, San Francisco, California" (ChaduxTt 2010a) to achieve the remedial action objectives (RAOs) and the construction is described in detail in this RACR. This RACR also documents the achievement of the RAOs for Parcel G related to groundwater treatment and institutional controls (ICs) as presented in the ROD for the parcel (Navy 2009).

This RACR complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, the National Oil and Hazardous Substances Pollution Contingency Plan in Title 40 of the Code of Federal Regulation Part 300, and California Health and Safety Code, Section 6.8.

1.1 Document Organization

Section 1 provides background for Parcel G and an overview of the RA activities that were performed at the Parcel to fulfill the requirements of the ROD. Section 2 presents the RAOs that were identified in the ROD related to the durable cover, groundwater treatment, and ICs (Navy 2009). Section 3 summarizes the materials and methods that were used to implement the durable cover RA. Section 4 describes the groundwater treatment portion of the final remedy. Section 5 describes the ICs portion of the final remedy. Section 6 describes activities currently ongoing at the parcel to maintain the remedy, and provides information that demonstrates completion of the RA described herein and the achievement of all associated RAOs identified in the ROD (Navy 2009). Section 7 describes the community relations activities associated with the RA. Section

8 summarizes the costs to implement the RA. Section 9 presents the RACR certification statement. Section 10 lists all documents and supporting information used to prepare this RACR.

The following appendices provide additional information documenting the durable cover RA:

- Appendix A – Concentration Trend Graphs for Groundwater
- Appendix B - Photographic Field Log
- Appendix C – Air Quality Monitoring Reports
- Appendix D – Contractor Quality Control Documentation
- Appendix E – CERCLA Stormwater Plan
- Appendix F – State Historic Preservation Officer Finding of No Adverse Effects
- Appendix G – Ecological Report
- Appendix H – As-Built Drawings

1.2 Background Information

The following sections briefly describe HPNS and Parcel G, including the location, history, geology and hydrogeology, and nature and extent of contamination.

1.2.1 Site Location

HPNS is located in San Francisco, California (Figure 1). The overall HPNS property encompasses approximately 866 acres on a peninsula that extends into San Francisco Bay in the southeastern portion of San Francisco. HPNS is divided into 11 parcels: B, C, D-1, D-2, E, E-2, F, G, UC-1, UC-2, and UC-3 (Figure 2). Parcel G occupies approximately 40 acres in the center of HPNS and does not border San Francisco Bay. This entire parcel was originally paved, except for its southeast corner (Figure 3).

Parcel G is bounded on the north and south by Spear Avenue and Manseau Street, respectively; and on the east and west by Morrell and H Streets, respectively. Parcel G is crossed by four streets in the north-south direction; from east to west they are Morrell, Cochrane, Hussey, and H Streets.

1.2.2 History

Naval shipbuilding, repair, and maintenance activities occurred at HPNS between 1939 and the 1960s. After World War II, HPNS was used for the decontamination of ships used for atomic weapons testing in the South Pacific and as the location of the Naval Radiological Defense Laboratory from 1946 to 1969. HPNS was made inactive in 1974 and most of the property was leased to Triple A Machine Shop, Inc., a private ship repair company, between 1976 and 1986. The Navy reoccupied HPNS in 1987. Parcel G was formerly used for industrial support that included office and commercial activities such as shipping and ship repair.

1.2.3 Geology and Hydrogeology

This section summarizes the geologic and hydrogeologic conditions at HPNS and Parcel G. The information presented in this section was adapted from the Remedial Design (RD; ChaduxTt 2010a).

The peninsula that forms HPNS is within a northwest-trending belt of Franciscan Complex bedrock known as the Hunters Point Shear Zone. HPNS is underlain by five geologic units: the youngest of Quaternary age, and the oldest, the Franciscan Complex bedrock, of Jurassic-Cretaceous age. In general, the stratigraphic sequence of these geologic units, from youngest (shallowest) to oldest (deepest), is as follows: Artificial Fill, Undifferentiated Upper Sand Deposits, Bay Mud Deposits, Undifferentiated Sedimentary Deposits, and Franciscan Complex Bedrock.

Artificial Fill covers the entire surface at Parcel G. The Bay Mud separates the Undifferentiated Upper Sands and the Artificial Fill from the lower Undifferentiated Sedimentary Deposits throughout Parcel G.

The Franciscan Complex contains a variety of rock types, including basalt, chert, sandstone, shale, and serpentinite. Some of these rock types contain wide-ranging concentrations of naturally occurring metals; serpentinite also contains naturally occurring asbestos minerals.

Parcel G consists of flat lowlands with surface elevations between 7 and 11 feet above mean sea level (msl). The parcel was constructed in the 1940s by placing borrowed fill material from various sources, including crushed serpentinite bedrock from the adjacent highlands as well as dredged sediments.

The hydrostratigraphic units at Parcel G include the A-aquifer, the aquitard, the B-aquifer, and the deep bedrock water-bearing zone. The A-aquifer consists mainly of unconsolidated Artificial Fill that overlies the aquitard and bedrock and forms a continuous zone of unconfined groundwater across the parcel. Undifferentiated Upper Sand Deposits and shallow bedrock also are part of the A-aquifer at various locations across Parcel G. The A-aquifer extends to about 15 feet below msl over most of Parcel G with depths to groundwater ranging from 2 to 10 feet below ground surface. The B-aquifer consists mainly of discontinuous lenses of Undifferentiated Sedimentary Deposits that overlie bedrock or are contained within the Bay Mud Deposits at a few locations. Bay Mud Deposits act as an aquitard that separates the A- and B-aquifers throughout Parcel G. The aquitard zone varies in thickness but extends from about 15 to about 45 feet below msl and is thickest in the southern sections of the parcel. The B-aquifer is found at depths ranging from about 10 feet below msl in the central part of Parcel G to around 40 feet below msl in the southern portion (depth to groundwater of approximately 17 feet below ground surface). The bedrock water-bearing zone is not considered an aquifer because of its low capacity for water production (primarily from fractures). The bedrock surface dips eastward toward the bay from about 5 feet below msl in northern Parcel G to about 90 feet below msl at the southern parcel boundary.

Groundwater elevations in the A-aquifer at Parcel G range from about 5 feet above msl in inland (northern) areas to near msl in southern areas closer to the shoreline. In general, groundwater flows to the southeast and southwest, away from a slight groundwater divide along the central, long axis of the parcel and follows the topographic gradient toward San Francisco Bay (ChaduxTt 2010a).

1.3 Remedial Actions Completed

The Navy identified known or potential chemical releases at Parcel G, and environmental investigations were conducted to identify and assess the nature and extent of contaminants in soil and groundwater. The ROD (Navy 2009) and the Final Revised Feasibility Study Report (FS) for Parcel D, which originally included the Parcel G area (SulTech 2007), present more details on the nature and extent of contamination at Parcel G. The following subsections summarize the current extent of contamination and the remedies implemented to fulfill the requirements of the ROD.

The selected remedies described in the ROD for Parcel G that together comprise the final RAs are: Alternative S-5 for soil, which includes excavation of contaminated soil followed by offsite disposal, covers, and ICs; Alternative GW-4 A&B for groundwater, which involves treatment of groundwater impacted by volatile organic compounds (VOCs) and metals with organic compounds or zero-valent iron (ZVI) followed by monitoring and ICs; and Alternative R-2 for radiologically impacted structures, which includes surveying existing structures, followed by excavation and offsite disposal of contaminated materials and soil. The selected remedies that comprise the final RAs have been fully implemented as described in this RACR. Groundwater monitoring in accordance with the ROD is ongoing and ICs have been fully implemented and will be memorialized prior to property transfer.

This RACR addresses the durable cover portion of the soil remedy, the groundwater treatment portion of the groundwater remedy, and ICs at Parcel G. The durable cover, groundwater treatment, and ICs constitute the final components of the overall RA required by the ROD at Parcel G.

1.3.1 Soil

Naturally occurring metals (arsenic and manganese) are present in the imported bedrock fill upon which portions of HPNS was built. The bedrock fill from Parcel A and dredge spoils that were used to build the Parcel G area in the 1940s are presumed to be the source of metals other than lead, such as arsenic and manganese with concentrations above the project action level (PAL). Lead and polycyclic aromatic hydrocarbons (PAHs) resulting from industrial activities were the COCs present in the soil at Parcel G that posed a potential risk to human health based on current and reasonably anticipated future land uses. The remedy selected in the ROD (Alternative S-5) involved the excavation of contaminated soils and offsite disposal, installation of durable covers, and implementation of ICs (Navy 2009; ChaduxTt 2010a).

The Navy excavated residual lead and PAHs in 2010 and 2011 that were not previously removed as part of removal activities that began in 1991 to address the contaminated soil removal component of the selected remedy. Excavations were in areas where concentrations of lead and PAHs exceeded remedial goals (Engineering/Remediation Resources Group, Inc. [ERRG] 2011). These soil removal actions met the remedial goals established in the ROD and have received approval by the regulatory agencies. The soil removals and verification that the RAOs have been met for that portion of the remedy are summarized in the RACR for Hotspot Locations (ERRG 2011).

The remedy, as stated in the ROD (Alternative S-5), consists of excavation of contaminated soil followed by off-site disposal, covers, and ICs. The remedy has been completed by means of residual lead and PAH excavation and off-site disposal (ERRG 2011), the durable cover, and ICs. This RACR addresses the durable cover and ICs to complete the requirements of Alternative S-5. Detail regarding the durable cover portion of the remedy is provided in Section 3 of this RACR, and additional information regarding the ICs is provided in Section 5.

1.3.2 Radionuclides

The Navy identified radiologically impacted sites, including buildings, equipment, and infrastructure at Parcel G associated with the former use of general radioactive materials and decontamination of ships used in atomic weapons testing in the South Pacific (Naval Sea Systems Command 2004). The Navy conducted a time-critical removal action (TCRA) to address potential radioactive contaminants in buildings, fill areas, former building sites, storm drains, and sanitary sewers at Parcel G to complete the requirements of Alternative R-2 of the ROD (Navy 2006 and Navy 2009).

The TCRA involved (1) surveying radiologically impacted structures and former building sites; (2) decontaminating (and demolishing if necessary) buildings and former building sites; (3) excavating radiologically impacted structures and former building sites; (4) excavating radiologically impacted storm drain and sanitary sewer lines; and (5) screening, separating, and disposing of radioactively contaminated excavated materials at the offsite, low-level radioactive waste facility. The radionuclides of concern at Parcel G include cesium-137, cobalt-60, plutonium-239, radium-226, strontium-90, thorium-232, tritium (hydrogen-3), and uranium-235.

The cleanup associated with the TCRA for radionuclides met the remedial goals established in the ROD as Alternative R-2. As a result, all areas on Parcel G have been remedied for radionuclides and have received approval for free release by the regulatory agencies (ChaduxTt 2010a and California Department of Public Health 2012).

1.3.3 Groundwater

The COCs in groundwater at Parcel G that pose a potential risk to human health based on current and potential future land uses are: chloroform, methylene chloride, trichloroethene (TCE), benzene, carbon tetrachloride, naphthalene, tetrachloroethene (PCE), xylene (total), arsenic, chromium VI, and nickel (Navy 2009). In accordance

with the ROD the Navy conducted a treatability study at Parcels G and D-1 in 2008 to evaluate technologies to address COCs in groundwater (Alliance Compliance Group 2010), which concluded that Parcel G contained two VOC plumes that required treatment. The treatability study implemented the remedy selected in the ROD (Alternative GW-4A&B) by addressing the VOC plumes at Installation Restoration (IR) Sites 9 and 71 using zero valent iron (ZVI). Based on the risk assessment completed, groundwater treatment of other areas for VOCs or metals was not necessary (Alliance Compliance Group 2010).

The post-injection results at IR Sites 9 and 71indicated that concentrations of VOCs in groundwater were below the remedial goals established in the ROD, except for one area in the deeper part of the A-aquifer at IR Site 9. However, groundwater samples from the shallower portion of the A-aquifer at this location in IR Site 9 were below remedial goals (Alliance Compliance Group 2010). The Navy decided, with concurrence from the BRAC Cleanup Team (BCT), not to continue to treat the deeper portions of the A-aquifer because the risk related to VOCs in groundwater was based on migration of volatile chemicals to indoor air, and the treatability study concluded that the associated risk to a commercial/industrial worker in this scenario was less than the target risk threshold.

The ROD identified a potential risk to saltwater aquatic organisms from concentrations of chromium VI and nickel in groundwater at Parcel G that could discharge into San Francisco Bay (Navy 2009). Results from samples collected under the basewide groundwater monitoring program (BGMP) do not indicate that chromium VI or nickel pose a risk to ecological receptors in the bay as demonstrated in the Remedial Action Monitoring Plan (ChaduxTt 2010a) and the Final Technical Memorandum for Monitoring Program Optimization in Parcels B, D-1, G, and UC-2 (CE2-Kleinfelder 2012).

As part of the BGMP, groundwater monitoring wells at Parcel G are sampled for VOCs and metals to confirm that the groundwater RAOs included in the ROD continue to be met (CE2-Kleinfelder 2012 and CE2-Kleinfelder 2013a). The results of recent groundwater monitoring conducted through the BGMP are included on Figure 4 and groundwater concentration trend graphs summarizing five to twenty years of groundwater data (depending on monitoring well) are included as Appendix A.

Remedy GW-4 A&B, as stated in the ROD (Navy 2009), consists of treatment of VOCs and metals with biological substrate or ZVI, groundwater monitoring, and ICs to address groundwater contamination. The remedy has been completed by means of a

treatability study (Alliance Compliance Group 2010), ICs, and groundwater monitoring (CE2-Kleinfelder 2012). This RACR addresses the treatability study and ICs to complete the requirements of Alternative GW-4 A&B. Additional detail regarding the groundwater treatment portion of the remedy is provided in Section 4 of this RACR, and additional information regarding the ICs is provided in Section 5.

1.3.4 Soil Vapor

The primary volatile COCs at Parcel G, based on their presence in soil gas sampling, include benzene, carbon tetrachloride, chloroform, PCE, and TCE (Sealaska Environmental Services [Sealaska] 2012). The Navy has developed action levels for soil gas to guide future vapor mitigation or remediation (ChaduxTt 2010b). In 2010, the Navy implemented a focused soil gas survey to identify locations where concentrations of COCs in soil gas may exceed action levels and to evaluate the extent of VOC areas requiring ICs or remediation (ChaduxTt 2010b; Sealaska 2012).

The ROD initially specified all of Parcel G as an area requiring institutional controls (ARIC) to ensure that the risks of potential exposures to VOC vapors are reduced to acceptable levels that are adequately protective of human health. In accordance with the ROD, soil vapor surveys were conducted after the groundwater cleanup actions for the following purposes: (1) to evaluate potential vapor intrusion risks, (2) to identify COCs for which risk-based numeric action levels for VOCs in soil gas would be established, (3) to identify where the initial ARIC for VOCs would be retained and where they would be released, and (4) to evaluate the need for additional remedial action in order to remove ARICs.

Six of the 42 grid blocks designated for ARIC consideration and modification at Parcel G contained COCs at concentrations exceeding the soil gas action levels for TCE, PCE, and chloroform. The report concluded that effects on human health should be reevaluated for any grid block where excavation is planned or performed as part of remedial action or future construction in coordination with the regulatory agencies. The Technical Memorandum Soil Vapor Investigation at Parcels B, D-1, G, and UC-2, Hunters Point Naval Shipyard, San Francisco, California (Sealaska 2013) summarizes the results of the soil gas survey and presents changes to the ARIC for VOC vapors and the rationale for the changes.).

The current ARIC (Figure 5) will be incorporated in the documents describing the ICs (Covenant to Restrict Use of Property and Quitclaim Deed) after review and approval by the Federal Facility Agreement (FFA) signatories. To ensure that risk from potential

exposures to VOC vapors is reduced to levels adequately protective of human health, proposed construction activities within the grid blocks designated as ARICs for VOC vapors must be approved in accordance with the land use control remedial design (LUC RD), Covenant(s) to Restrict Use of the Property, and Quitclaim Deed(s). Additional detail regarding the ICs implemented in fulfillment of the ROD is included in Section 5 of this RACR.

2. Remedial Action Objectives

The RD for the durable cover and LUCs at Parcel G (ChaduxTt 2010a) and the groundwater treatability study work plan (Alliance Compliance Group 2008) were developed to address the RAOs established in the Final ROD (Navy 2009) for soil and groundwater. The soil RAOs have also in part been demonstrated to have been met in the Final RACR for Soil Hotspot Locations at Parcels B, D-1, and G and Stockpiles at Parcels D-1 and G (ERRG 2011). The radiologically impacted soil and structures RAOs were met and previously demonstrated in the Radiological RACR for the storm drain, sanitary sewer, building, and former building (Tetra Tech EC Inc. [Tetra Tech] 2011).

RAOs for soil, soil gas, and groundwater were based on attainment of regulatory requirements, standards, and guidance for contaminated media, COCs, potential receptors and exposure scenarios, and human health and the ecological risks. Planned future land use was an important component in developing the RAOs. The RAOs for Parcel G are based on the Former San Francisco Redevelopment Agency 1997 reuse plan. The following subsections identify the RAOs that apply to the durable cover, groundwater treatment, and ICs at Parcel G (Navy 2009).

Soil RAOs:

1. Prevent exposure to organic and inorganic chemicals in soil at concentrations above remedial goals developed in the Human Health Risk Assessment for the following exposure pathways.

    a. Ingestion of, outdoor inhalation of, and dermal exposure to surface and subsurface soil.

    b. Ingestion of homegrown produce by residents in mixed-use blocks.

2. Prevent exposure to VOCs in soil gas at concentrations that would pose unacceptable risk via indoor inhalation of vapors. Remediation goals for VOCs to address exposure via indoor inhalation of vapors have been superseded based on COC identification information from soil gas surveys. Action levels were established for soil gas, which account for vapors from both soil and groundwater, and were calculated based on a cumulative risk level of 10^{-6} using the accepted methodology for risk assessments at HPNS.

Groundwater RAOs:

1. Prevent exposure to VOCs in the A-aquifer groundwater at concentrations above remedial goals via indoor inhalation of vapors from groundwater. This RAO for exposure to vapors from groundwater via vapor intrusion has been superseded by remediation goals established for soil vapor (ChaduxTt 2011b; Sealaska 2013).

2. Prevent direct exposure to the groundwater that may contain COCs through the domestic use pathway (for example, drinking water or showering).

3. Prevent or minimize exposure of construction workers to metals and VOCs in the A-aquifer groundwater at concentrations above remedial goals from dermal exposure and inhalation of vapors from groundwater.

4. Prevent or minimize migration to the surface water of San Francisco Bay of chromium VI and nickel in A-aquifer groundwater that would result in concentrations of chromium VI above 50 micrograms per liter (µg/L), and nickel above 96.5 µg/L at the point of discharge to the Bay.

Radiologically Impacted Soil and Structures RAOs:

1. Prevent exposure to radionuclides of concern in concentrations that exceed remedial goals for all potentially complete exposure pathways.

3. Durable Cover Remedial Action

This section summarizes construction activities to complete the RA associated with the installation of durable covers (i.e., asphalt covers and repair of existing building foundations) at Parcel G. All construction activities were overseen by a qualified professional engineer and Contractor Quality Control (CQC) Manager. In addition, all work was performed in accordance with the precautions and practices, and using the personal protective equipment (PPE), specified in the Accident Prevention Plan (APP) and Site Safety and Health Plan (SSHP; ARCADIS 2012b). The RA included the following work elements:

- Pre-construction meeting
- General site controls
- Mobilization and site preparation
- Import, installation, and grading of AB
- Repair, installation, and/or improvement of asphalt covers
- Pouring of concrete pads
- Inspection and repair of building foundations and exterior concrete cracks or voids
- Installation of k-rails around the perimeter of the site
- Post-construction activities, including site cleanup, demobilization, completion inspections, and as-built site surveying

Any deviations or modifications to the RA are discussed following the description of the specific work elements. Appendix B contains a photographic field log of the construction activities performed at the site.

3.1 Project Overview

The RA was implemented at Parcel G to prevent human exposure to metals and other potential COCs in soil. A durable cover was the remedy selected to prevent/minimize

contact with COCs that may be present at Parcel G. The durable cover over all portions of Parcel G consists of new or repaired asphalt covers and repaired building foundations. These covers are considered durable because they are non-erodible and would require deliberate and destructive actions to expose the underlying soil.

The primary design criterion for durable covers, as specified in the RD, is to minimize human exposure to potentially contaminated soil. The existing asphalt pavement, building foundations, concrete pads, and other monolithic items met this criterion where they were intact or where they were repaired or replaced as part of the RA (ChaduxTt 2010a). The existing asphalt pavement when not in good condition was repaired as necessary or replaced. Areas of heavily degraded asphalt pavement and exposed soil received new asphalt pavement. The initial surface conditions observed over the site are presented on Figure 6. The final surface over Parcel G is a continuous, intact durable cover that minimizes exposure to potentially contaminated soil.

The existing building foundations minimize human contact with potentially contaminated soil beneath the buildings. The building foundations were inspected and repaired as needed to prevent exposure to underlying soil and meet the durable cover requirements identified in the RD (ChaduxTt 2010a).

Section 3.5 of this report includes the details of the cover construction. In summary, the RA included the following activities as part of the installation of durable covers over Parcel G:

- Existing asphalt pavement not requiring crack or surface repairs was left in place and sealed with an asphaltic slurry mix.

- Existing exterior concrete pads, foundations, utilities, railroad tracks, and other permanent structures within intact paved areas and did not affect meeting proper drainage grade were left in place in their current condition and either sealed, paved, or tied into the new durable covers.

- Filling cracks in existing asphalt pavement, exterior concrete pads, and other items considered suitable for use as part of the durable cover.

- Where an existing aggregate base (AB) layer was present and exposed at surface, or underlying a degraded asphaltic concrete (AC) layer, the area was prepared and the AB layer was reused in the construction of the durable cover. These areas received a new AC surface layer.

- Where no AB was present, a layer of 4 inches of AB was installed and 2 inches of AC was placed over it.

- Drainage swales and other voids (i.e., utility trenches and former concrete pads) were constructed using concrete.

- The paving subcontractor and third-party testing company performed testing to verify that the materials, materials placement, and cover construction met the RD and the design specifications.

- Filling cracks and voids in existing building foundations, as needed, to minimize contact with underlying soil.

- Access closure of crawl spaces or gaps in foundations to minimize contact with underlying soil.

As part of the RA, k-rail barriers were installed and surround Parcel G to prevent vehicle access to the site. The barrier is the initial preventative element of the remedy to limit exposure to the underlying soil by restricting unauthorized access to the site. The durable cover is the preventative element of the remedy to restrict unauthorized users of the site from accessing the underlying soil.

Figure 7A/B show cross sections of the initial conditions and the asphalt covers applied. Figure 8 shows the extent of the final cover types.

3.2 Construction Schedule

Table 1 summarizes the construction schedule for the durable cover RA. As detailed in Table 1, the construction portion of the RA was initiated in January 2013 and was completed in June 2013.

3.3 Pre-Construction Existing Conditions Survey

ARCADIS conducted field visits to assess the surface and near surface conditions of the site between June 18 and June 22, 2012. Inspections included assessments of the site building foundations and the areas of the site between the buildings. The purpose of the conditions survey was to better account for the existing surface, provide detail regarding the types and extents of the covers needed, and identify materials for reuse. These conditions were then verified prior to construction to confirm there had not been

any deviations from the original conditions. Additional details regarding the existing conditions survey are located in the Remedial Action Work Plan (RAWP; ARCADIS 2012a), specifically Appendix G of the RAWP.

Approximately 35 percent of the total parcel area is covered with concrete building foundations. The building foundations were generally observed to be in good intact condition with minor areas requiring repairs to meet the durable cover requirements. False floors were observed in Building 411. Crawl spaces or accessible gaps in the foundations were observed in Buildings 351, 351A, 411, and 424.

The remainder of the total parcel area, approximately 65 percent of the area, is the exterior portions of the site. These areas were assessed by establishing a grid where the various surface and below-surface conditions within each grid were characterized. Through this process, the AC layer that covered Parcel G throughout its operations history was observed extensively over the site at varying depths underlying the upper layer of imported material. Figure 6 provides the initial ground surface conditions assessment results.

The following conditions were observed over the site outside of the buildings:

- AC pavement that meets requirements of the durable cover with minor repair such as application of a seal coat.
- Heavily degraded AC pavement requiring more significant rehabilitation.
- Areas of imported road base material overlying the historical AC and overlying areas where prior RAs for the removal of utilities were conducted, as documented in the RACRs of the Remedy for Radionuclides and Soil Hotspot Removal (Tetra Tech 2011; ERRG 2011).
- Clean crushed drain rock overlying the four north south swales was identified as suitable for incorporation into the durable cover in the RACR of the Remedy for Radionuclides (Tetra Tech 2011).
- Areas of exposed soil without an AB layer and without the underlying historical AC pavement.
- Hardscape or monolithic features that meet the requirements of the durable cover such as concrete pads, concrete utility chases, and building aprons.

3.4 Pre-Construction Meeting

ARCADIS hosted a pre-construction (kickoff) meeting on January 11, 2013. This meeting was attended by the Navy's Remedial Project Manager (RPM), the Resident Officer in Charge of Construction (ROICC), and the Caretaker Site Office (CSO) representatives, along with the entire construction management team including major subcontractors. During the meeting, ARCADIS arranged with the CSO representatives and ROICC to establish locations or alignments for construction laydown areas, equipment staging areas, and haul routes. ARCADIS also reviewed the project planning documents and discussed their implementation plan and schedule.

3.5 General Site Controls

This section discusses site management and site controls including:

- Site access, security, and working hours
- Aboveground and underground utility clearance
- Land surveying
- Air monitoring
- Stormwater Pollution Prevention
- Archaeological monitoring
- Traffic routing and control
- Ecological monitoring

3.5.1 Site Access, Security, and Working Hours

Prior to mobilization, security passes were acquired for HPNS from the onsite Successor Agency to the San Francisco Redevelopment Agency office for all anticipated site workers and visitors. All field personnel, including subcontractors, checked in at the guard station when entering HPNS and were required to have an HPNS badge or an escort to enter the former shipyard.

Regular working hours were between 7:00 a.m. and 5:00 p.m., Monday through Friday, excluding federal holidays. Most work was performed during normal work hours. When work outside of regular working hours was required (i.e., government holidays that did not apply to ARCADIS or its subcontractors), the CSO representatives, ROICC, and Navy RPM were notified via email. To minimize the disturbance to the neighboring community, work was performed during normal working hours as much as possible.

A temporary construction perimeter fence was installed around Parcel G and was in place during all construction activities to prevent unauthorized access to the site during construction (Figure 9). In accordance with the RD, a physical barrier has been installed around the perimeter of the site to restrict vehicle access and will be maintained as part of the ongoing operation and maintenance (O&M) activities.

3.5.2 Aboveground and Underground Utility Clearance

Prior to conducting any construction activities, Underground Service Alert of Northern California (USA North) was notified at least 72 hours prior to initiating the work. USA North contacted the utility companies with publically owned underground utilities in the vicinity to locate and clear the work area. An independent underground locating company was subcontracted to perform utility clearance in the areas where construction work was performed. Active underground and aboveground utilities were marked and flagged clearly and protected in place.

As a result of the work being performed primarily at the existing ground surface, there was little contact with existing active or abandoned underground utilities during the construction of the remedy.

3.5.3 Land Surveying

Site surveying was conducted throughout the construction process to maintain elevation control in the project area. The construction progress and final completion topographic surveys were performed by a California licensed land surveyor. Initial topographic survey was completed in June 2012. The as-built topographic survey was completed in June 2013 (Appendix H). Two brass monuments were installed onto the final cover in accordance with the RD to monitor settlement as part of O&M activities.

Grade checking was performed throughout earthwork to confirm target elevations for placement of material. Water flows across the cover toward the drainage channels. The perimeter of each building has been sloped to drain stormwater and minimize

accumulation in the vicinity of the building foundations. A professional civil engineer oversaw all surveying and grade checking activities.

All site surveying was conducted to an accuracy of 0.1 foot horizontally and 0.01 foot vertically. All horizontal coordinates were based on the following surveying control datum: (basis of bearings) North American Datum 27 Zone-III (Hunters Point West 1 PID HT0613). All vertical elevations were based on the following surveying control datum: (benchmark) National Geodetic Vertical Datum 29 (corrected).

3.5.4 Air Monitoring

Two site-specific air monitoring stations were set up around the perimeter of the site during mobilization and operated throughout the entire period of construction in accordance with the project Environmental Protection Plan Part 1 – Dust Control Plan, included with the RAWP (ARCADIS 2012a) and in accordance with the Basewide Dust Control Plan (Tetra Tech 2009). Each monitoring station included separate monitoring systems for (1) total suspended particulates, arsenic, chromium, lead, and manganese; (2) particulate matter larger than 10 microns in size; and (3) asbestos. The air monitoring results provided as Appendix C describe (1) where and how air monitoring samples were collected, (2) what test methods were used to analyze air monitoring samples, and (3) how air monitoring data were evaluated.

The reported results also summarize data collected from the air monitoring stations and compare the air monitoring results with the established threshold criteria included in the project Dust Control Plan. As shown in Appendix C, no exceedances of airborne dust standards were recorded during construction activities.

In addition to upwind and downwind monitoring, real-time work zone monitoring for dust was performed to protect site workers. The work zone monitoring data is included in the daily health and safety reports contained in the daily CQC documentation (Appendix D). The readings were recorded on daily air monitoring field logs. No exceedances of the PALs were recorded during real-time dust monitoring throughout the construction period; therefore, no modifications were made to the dust control measures being implemented during the construction.

Personal air monitoring was conducted to assess worker exposure to site COCs for each type of work where dust could be of concern at the start of the project during grading activities when dust was of the greatest concern, as described in the APP (ARCADIS 2012b). Samples were collected throughout the work day during grading

activities and were analyzed for metals in airborne dust. Personal air monitoring was completed to assess worker exposure to site COCs and determine appropriate level of PPE. Air monitoring results were below detection limits for metals and additional personal air monitoring was not required. Personal air monitoring results are also provided in Appendix C of this RACR.

3.5.5 Stormwater Pollution Prevention

Environmental controls, including stormwater and construction best management practices (BMPs), were implemented in accordance with the project Environmental Protection Plan Part 2 - CERCLA Stormwater Plan (Appendix E; ARCADIS 2012a). Environmental controls were maintained, as needed, throughout the entire duration of the project. Also, weekly, pre-storm, storm, and post-storm inspections were performed throughout the construction period. No unauthorized stormwater or non-stormwater discharges occurred from the work area during construction.

Stormwater BMPs included installation of fiber rolls, check dams, drain filters, dust control agents, and sand bags as needed to control and prevent erosion. Implementation of stormwater controls followed the requirements of the California General Permit for Discharges of Storm Water Associated with Construction Activity.

Small volumes of stormwater (less than 1,000 gallons) that had accumulated on portions of the existing ground surface were pumped to the drainage swales when necessary to allow for a dry working surface. Water pumped to the swales infiltrated into the subsurface of Parcel G and no off site discharge from Parcel G occurred.

3.5.6 Archaeological Monitoring

The Navy prepared and submitted a letter of notification to the State Historic Preservation Office (SHPO). The letter notified the SHPO of the RA and that work would be conducted within or near to potentially archeologically sensitive areas. The letter was submitted for SHPO approval and was received before any intrusive activities within archaeologically sensitive areas began. The State Historic Preservation Officer concurred with the Navy finding of no adverse effects to historic properties (Appendix F). No archaeological resources were discovered during the RA.

3.5.7 Traffic Routing and Control

Onsite and offsite roads were used to mobilize and demobilize heavy equipment and to transport materials and equipment to and from Parcel G and HPNS. Traffic routes and controls were selected to maximize safety and convenience for motorists, pedestrians, and workers during construction activities. The project team worked closely with the ROICC and CSO representatives to coordinate all construction activities that generated traffic to avoid conflicts with other activities on the base. Traffic routes were reviewed and modified, as necessary, throughout the period of construction.

Traffic controls were used for the efficient completion of work activities in a safe working environment, while minimizing the impact on normal traffic flow. They were also used to minimize the amount of materials tracked from the site. Traffic controls included:

- Loading and transporting materials, equipment, or debris during off-peak hours to minimize disruptions to facility traffic.
- Reducing traffic by encouraging construction workers to carpool to the site.
- Using cones, flags, signs, and other measures to facilitate loading and unloading of materials, as necessary.
- Installing rumble strips and when necessary decontaminating equipment with a pressure washer to control track-out of soil and reduce source material for dust.

Field personnel complied with the “Access and Haul Road Plan and Traffic Controls” included as Appendix C to the RAWP (ARCADIS 2012a).

3.5.8 Ecological Monitoring

During pre-construction work for the remediation of Parcel G in late January 2013, a burrowing owl (*Athena cunicularia)* was observed in front of openings in broken concrete and rubble areas located west of Building D-A. The Navy requested that ARCADIS provide assistance to ensure compliance with the Migratory Bird Treaty Act.

Two burrowing owls were observed at various times during the two-month investigation period (February and March) during full-time monitoring by a qualified and experienced biologist with burrowing owl experience. The burrowing owls were sporadically

observed at three onsite locations (burrows west of Building D-A, a utility vault south of Building 351, and the rafters of Building 437) and under an offsite I- beam. During the burrowing owl monitoring period, the two owls observed appeared solitary. At no time during the monitoring period were the two owls observed at the same location and there were no indications of nesting. In mid-March, the owls were no longer observed. Full-time monitoring was conducted for an additional two weeks with no additional observations of owls, at which time monitoring was discontinued. The full ecological report is provided as Appendix G to this RACR.

3.6 Mobilization and Site Preparation

This section discusses site management activities, including the following specific tasks:

- Equipment mobilization
- Establishment of support and construction work areas
- Groundwater monitoring well protection

3.6.1 Equipment Mobilization

The following equipment and materials were mobilized to HPNS Parcel G, as needed for performance of the RA:

- Support equipment
- Portable toilets and hand wash stations
- Heavy equipment
- Traffic controls (e.g., flags, barricades, signs)
- PPE
- Decontamination supplies
- Spill response kits

- Hand tools
- Safety equipment (e.g., fire extinguishers, first-aid kits, dust monitors)

3.6.2 Establishment of Support and Construction Work Areas

Figure 9 shows the layout of the support and construction zones. The temporary field trailer was located on the southern portion of the site inside Building 439 adjacent to Manseau Street. The field trailer was used to maintain all project plans and construction records, including the RAWP (ARCADIS 2012a), contractor production reports, CQC documentation, and health and safety documents throughout the period of construction. The field trailer was also used to hold CQC and project team meetings.

The support areas for equipment and material staging were located in the southern portion of the site inside Building 439. The support areas consisted of:

- A storage area for equipment and a laydown area for materials
- Lockable storage boxes for small equipment, materials, and sample processing supplies
- An area for onsite sanitary facilities

Potable water was procured from offsite sources (i.e., bottled water). Electrical power needs were satisfied with mobile gas-powered generators.

For the duration of construction, ARCADIS maintained a restricted access work zone to control unauthorized access. Access to the construction work areas was controlled in accordance with the RAWP, and field personnel, including subcontractor personnel, complied with all precautions, practices, and PPE requirements to ensure health and safety, as specified in the APP and the SSHP.

Support zones, exclusion zones, and the contamination-reduction zones were set up as specified in the APP. Wet and dry decontamination stations were installed in the contaminant-reduction zone consisting of rumble strips and pressure washing stations for vehicles, and PPE disposal areas and decontamination stations were installed for site workers.

3.6.3 Groundwater Monitoring Well Protection

The groundwater monitoring wells located throughout the Parcel G property were protected during the construction period by leaving the original traffic-rated boxes in place for flush-mounted wells and traffic cones. In the case of aboveground wells present at the time of the durable cover construction, the well was protected from traffic accidents by maintaining existing bollards. Monitoring wells at Parcel G are managed and decommissioned under the BGMP. All remaining wells at Parcel G are of flush-mounted construction. The original well boxes protected the monitoring wells during mobilization and installation of the cover. Well boxes were modified and raised as needed to match the final durable cover elevation, following installation of the asphalt cover. Additional details regarding the raising of the monitoring wells are included in Section 3.8 of this report.

3.6.4 Site Preparation

Preparation of the existing ground surface was needed before construction of the durable cover could commence. This work included clearing of debris, loose rocks and concrete, fencing, vegetation, and general refuse. The following list summarizes the site preparation tasks:

- Vegetation was cleared and native soil or existing AB surface was graded as needed to establish the subgrade for the construction of the durable cover.
- Fencing and fence posts were removed as necessary to facilitate the placement of AB and AC.
- Areas of AC that met the requirements of a durable cover with minor repairs were prepared as needed for the repair work.

Refuse and excess materials present within some of the buildings were not removed. These materials were moved as needed to confirm and repair the foundations as needed.

After initial site preparation activities were completed, ARCADIS implemented the Grading, Drainage, and Paving Plan (ARCADIS 2012a) to establish elevation controls across the site. The Grading, Drainage, and Paving Plan incorporated existing fixed grade constraints such as building door thresholds, boundary conditions, and features

such as existing hardscape (e.g., concrete utility chases, as well as the large exterior concrete slabs, railroad tracks, and other intact site features).

3.7 Repair, Rehabilitation, and Installation of Asphalt Cover

The majority of Parcel G originally had been asphalt paved, which over time had degraded either naturally or as a result of remedial actions and construction activities. Figure 3 provides an aerial image of Parcel G from 2005 and shows the site being fully or near fully paved. Prior to remedial action, the asphalt pavement was in varying degrees of degradation that required rehabilitation and new construction to achieve the RAOs identified in the ROD (Navy 2009). All new asphalt pavement construction and rehabilitation work was conducted in accordance with the RD (Chadux Tt 2010a).

This section describes the following activities associated with repair and installation of the asphalt cover:

- Identification of repair locations and repair types
- Installation of asphalt seal coat
- Installation of asphalt overlay
- Installation of new pavements
- Installation and preparation of AB
- Installation of AC pavement
- Drainage improvements

This section provides details regarding the installation of the AC durable cover under the various pre-existing surface conditions that were present at the site and the overall phasing of its implementation. Appendix B contains a photographic field log of the construction activities performed at the site. Durable cover construction and repair methods are also summarized in Table 2 of this report. Existing AC surfaces and imported AB material present on the site before durable cover construction were reused to the extent possible in the construction of the final durable cover.

In all instances, a minimum 2-inch layer of AC is the final surface over the exterior portions of the site, excluding concrete pads and other monolithic items that met the requirements of being a durable cover. Underlying the upper layer of newly placed AC is imported AB material of varying thickness depending on the pre-existing conditions and the grade requirements. Site-wide, there is a minimum of 6 inches of separation between the soil potentially impacted with COCs and the final cover surface. This final durable cover meets the requirements of the ROD to minimize human exposure with the underlying soil and it is able to withstand the applied forces that could potentially degrade the cover.

Figure 8 identifies the paved areas that received the different repair treatments. Figure 10 provides the final site grade. In addition, Appendix H provides the detailed final topographic survey.

3.7.1 Existing AC in Functional and Repairable Condition

The following subsections discuss the types of surface conditions that were encountered and repairs necessary where the existing AC was determined to be in a functional condition requiring rehabilitation to meet the requirements of the ROD (Navy 2009). In these instances, the AC surface had either minor damage requiring sealing of cracks or was significantly damaged requiring the application of an asphalt overlay. In both instances the existing AC material was exposed at ground surface and was the working surface. These areas accounted for approximately 25 percent of the exterior ground surface area or about 16 percent of the total parcel area.

3.7.1.1 Application of Asphalt Seal Coat

The asphalt crack seal was applied to areas of exposed AC surfaces that meet the requirements of the durable cover with repair. The seal used was a blend of asphaltic emulsion mineral fibers and polymers formulated into a slurry to fill voids and cracks in the AC where underlying soil could be accessible. Asphalt seals were used to preserve and restore existing intact asphalt and create a continuous durable cover over those portions of the site preventing contact with the underlying soil through the cracks that were originally present. The application area accounted for about 17 percent of the total exterior ground surface area or 11 percent of the total parcel area. Asphalt seal was applied as follows:

1. Before applying asphalt seal to a location, the AC was swept clean and power blown with compressed air (or pressure washed, as necessary) to expose the AC and create a surface for the seal coat to bond.

2. Asphalt seal was applied by a sealing machine and broom-finished manually.

The flexible asphalt seal restored the AC condition and will reduce further cracking.

3.7.1.2 Installation of Asphalt Overlay

Areas of the pre-existing exposed AC that could not meet the durable cover requirements with simple crack repair and seal coating, and where conditions permitted, were designated for an AC overlay where additional AC layers were added over the existing surface. In these instances, the cracking and damage of the AC was extensive and beyond what could be repaired through directed crack filling and seal coating. These areas accounted for approximately 8 percent of the exterior ground surface area or 5 percent of the total parcel area. Asphalt overlay was installed as follows:

1. Before applying the overlay, the AC was swept clean to remove debris to expose the AC surface.
2. A pavement fabric was applied to the existing AC surface before placement of the new AC overlay layer.
3. A paving machine applied the overlay as a single 2-inch-thick lift of asphaltic mixture.
4. Compaction was performed with a smooth drum roller following application of the overlay.
5. Both the paving subcontractor and a third-party testing company (and certified offsite laboratory) tested the installed AC overlay to verify that the material and placement met the design specification in the RD.

3.7.2 New Pavement Construction

The portions of Parcel G where asphalt pavement was not exposed at the ground surface received new pavement construction. New construction included the reuse of the AB material present at the site and import of new AB material. New pavement was constructed on approximately 66 percent of the exterior ground surface area or about 44 percent of the total parcel area. Areas designated for new pavement construction based on the original conditions observed were:

- Existing surface road base material overlaying identified AC

- Existing surface road base material where underlying AC was not identified
- Existing surface soil with absence of both AB and AC

Areas of Existing Road Base Material

Original conditions over much of the site consisted of an existing underlying AC surface area overlain by approximately 2 to 6 inches of imported aggregate base material as described in the RACRs for Radionuclides and Soil Hotspot Removal (Tetra Tech 2011; ERRG 2011) and observed during the initial condition assessment. Over much of the site this imported AB overlies the asphalt pavement historically covering the site. In areas of previous removal actions and excavations, the historical AC had been removed and the AB was used as backfill and for leveling.

In these areas where 2 to 6 inches of imported AB material had existed, the durable cover was achieved by placing an additional leveling course of imported AB where needed to achieve the necessary grade elevations and meet the drainage and durable cover requirements. The overall thickness of the AB layer was a minimum of 4 inches. The AB surface was covered with a 2-inch thick layer of AC to achieve the final grade. The final total thickness of the durable cover including the existing AB, imported AB, and the AC is a minimum of 6 inches in these areas in accordance with the RD.

Areas of Exposed Soil

Areas where soil was encountered at the ground surface without presence of AB or AC received new pavement construction consisting of both layers of AB and AC. These areas were graded and compacted to establish proper subgrade as appropriate. Subgrade of minimal traffic areas was compacted to a minimum of 90 percent of the maximum dry density based on modified proctor testing. A minimum of 4 inches of imported AB and 2 inches of AC were applied to achieve the final cover grade and a total final thickness of at least 6 inches.

3.7.2.1 Installation and Preparation of Aggregate Base

Pre-existing AB material was located throughout the Parcel G site and was reused in the construction of the new asphalt pavement. This pre-existing AB material was supplemented with imported AB to meet grading and thickness requirements of the RD to serve as the foundation for the final AC surface over the site.

Approved AB material was imported and directly loaded into each area where required via dump truck. All AB material was certified to originate from concrete material and sieve size analysis was completed to confirm compliance with California Department of Transportation specifications for Class II aggregate base (Appendix D). The material was installed in accordance with the design specifications in the RD. AB was relocated as needed or placed on top of the pre-existing surface material as needed to 2 inches below the final grade. A smooth drum compactor was used to create a smooth working surface and to achieve compaction requirements in preparation for placement of the AC layer. Grade checkers were used to verify proper benchmark and survey control to confirm that AB was installed in accordance with the design. Both the paving subcontractor and a third-party company (and certified offsite laboratory) tested all installed AB to verify that the material type and placement met the requirements of the design specifications in the RD.

3.7.2.2 Installation of Asphaltic Concrete Pavement

AC was placed on smooth working surfaces comprising of compacted either original imported or newly imported AB. Before installing new AC on the compacted AB, the area was cleaned to remove loose material on the surface to be paved. AC meeting the project specifications was imported from a nearby AC manufacturing plant using dump trucks. The AC was loaded directly into an AC paving machine as it applied a 2-inch lift of AC over the areas to be paved. Lifts were placed and compacted with a smooth drum roller to meet the 2-inch thickness requirement and to achieve the final cover grade.

Both the paving subcontractor and a third-party company (and certified offsite laboratory) tested all installed AC to verify that the material type and placement met the requirements of the design specifications in the RD.

3.7.3 Site Drainage Improvements and Modifications

Pavement restoration and subgrade preparation were conducted in a manner that improves site drainage and directs runoff to the existing swales that run through Parcel G as specified in the Grading, Drainage, and Paving Plan (ARCADIS 2012a). This improvement was achieved by establishing proper pavement grades and slopes that allow for positive drainage away from buildings and into the four swales on Parcel G, which run north to south, and limits upland accumulation of stormwater. The grade within the drainage channels was improved as needed to achieve positive drainage and prevent accumulation of stormwater within the drains. The northern portion of

Parcel G was graded to receive sheet flow runoff from Parcel UC-1 and divert it to the upstream ends of the various swales on Parcel G.

The durable cover was installed to effectively drain water along the eastern Parcel G boundary with Parcel E and prevent significant run on from Parcel E. The asphalt pavement cover extends to the berm formed by the sanitary sewer pipe that runs north to south on H Street along the eastern Parcel G boundary to the Police Building (Parcel E Building 606) south of Manseau Street. This feature was used to form the cover separating runoff onto the respective parcels. Along the northern portion of H Street, no similar pre-existing feature existed, and a small swale was installed along the boundary to prevent water from running off Parcel G and onto Parcel E. The boundary conditions constructed collect runoff and divert it to the primary H Street drainage swale.

Drainage swales running along the north-south streets of the site and the areas directly adjacent to the swales were originally constructed of clean crushed drain rock suitable for use as AB. The swales were graded as necessary and a 3-inch layer of shot-crete was then applied over the AB to achieve the final cover grade and meet the durable cover requirements in accordance with the RD. The final surface facilitates stormwater flow from the upland site areas to the swales.

During initial field visits, it was observed that the drainage swales terminated prior to reaching the northerly stubouts of the existing receiving channel immediately south of the southern boundary of Parcel G on Parcel D-1. To address this and maintain continuity of drainage, a 36-inch corrugated plastic pipe culvert was placed at a minimum slope of 2 percent at the downstream end of Morrell and Cochrane Street swales to collect and convey flow to the existing stubouts of the receiving channel while simultaneously maintaining vehicular access along Manseau Street. A 36-inch corrugated plastic pipe was installed from H Street, and traveled underground south of building 439 to a custom made drop inlet located at the southern point of the Hussey Street swale. The Hussey Street swale flowed directly into the drop inlet, which was connected to the receiving channel via two 30-inch corrugated plastic pipes lying side by side. A concrete pad with reinforced steel was poured over the two 30-inch lines to allow vehicular access adjacent to Parcel D-1 along Manseau Street.

3.8 Existing Monitoring Wells and Other Monolithic Items

Existing groundwater monitoring wells were documented and inspected prior to construction and protected as needed during the construction of the cover (see Table 3 for a list of monitoring wells and Figure 4 for their locations). Monitoring wells were

repaired and raised as necessary to meet the final cover grade. In some instances the well box was raised above the original elevation by jack-hammer removal of the existing concrete and raising the well box to the new final cover elevation and setting the box in newly poured concrete. In no instances were the tops of well casings altered requiring resurvey of the wells.

Other monolithic items over the site such as concrete pads, concrete building aprons, and utility features and chases were tied into the final cover, if practical, and the area was sloped appropriately to achieve positive drainage. Monolithic concrete items were repaired in a similar manner to the building slabs and foundations whereby cracks greater than ¼ inch in width were repaired using a multipurpose concrete repair grout. Voids in utility structures were filled and 4 inches of concrete was placed, or a steel plate was welded across the vault opening. In areas with railroad tracks such as on Morrell Street, the AB leveling course was placed over the railroad ties and adjacent to rails to prepare the surface for AC. In some cases railroad tracks were removed and sent offsite for recycling. New AC pavement was applied adjacent to both sides and between the rails, which was leveled with a screed.

3.9 Inspection and Repair of Building Foundations

All buildings were inspected as part of the initial site survey activities to document foundation repairs necessary to qualify as a durable cover and prevent contact with underlying soil. Cracks in existing building foundations larger than ¼ inch were patched with cement mortar. Cracks smaller than ¼ inch will be monitored as part of the post-construction O&M at the site. Holes and damaged cavities in the existing concrete slabs were patched with mortar. Large existing concrete-lined pits were left in place once concrete repairs were complete to maintain a barrier from the underlying soil and the buildings will be secured. In cases where voids were established following the removal of utility chases inside buildings, concrete was poured and smoothed to meet the existing surrounding concrete slabs.

All buildings have been locked and secured to prevent unauthorized access. The securing of the buildings is the initial method for preventing contact with the soil underlying the building foundations. The foundation repairs and modifications conducted as part of the RA is the preventative measure in the event that unauthorized access occurs.

3.9.1 Building Foundation Void Space Elimination

In limited cases where access into existing crawl spaces was present within Buildings 351, 351A, 411, and 424, they were secured with galvanized woven wire mesh with maximum 1-inch square openings and secured to the foundation concrete. The wire mesh prevents humans from accessing lower portions of building foundations where contact with native soil may be possible. Existing concrete pits were found to be in sound structural condition during field observation and have been left in place and repaired as needed in order to meet the conditions for the durable cover.

In addition to securing the building foundations from access to the interior crawl spaces, a false floor was observed in Building 411. The false floor consisted of steel grates with 1-inch openings. The steel grates are raised a minimum of 18 inches above the underlying soil. The grates prevent access to the underlying soil and were left in place. Large gaps in the floors where grates were removed were covered with 1-inch steel plates overlapping the gaps and welded to the grates to prevent access to the underlying soil.

3.10 Installation of Access Restrictions and Signs

K-rails were installed around the perimeter of the site to prevent unauthorized access from vehicles and restrict unauthorized pedestrian access to the site. The K-rails are the initial preventative element to prevent unauthorized access to the site and prevent/minimize exposure to the underlying potentially impacted soil.

Informational signs were placed along the boundary to deter unauthorized access or disruption during construction of the cover. The signs were left in place after construction was completed.

3.11 Post-Construction Activities

The following post-construction activities were performed:

- Site cleanup and demobilization
- Completion inspections
- Post-construction (as-built) site topographic survey

The following subsections discuss each post-construction activity.

3.11.1 Site Cleanup and Demobilization

A final site cleanup was performed after construction and demobilization from the site was completed. All materials and rubbish from construction activities were removed. Upon finishing site cleanup and completing a site inspection with the CSO representative and ROICC, all equipment, personnel, facilities, temporary fencing, and equipment were demobilized from the work site.

3.11.2 Completion Inspections

Completion inspections included a Punch-Out Inspection, a Pre-Final Inspection, and a Final Acceptance Inspection. The inspections were performed in accordance with the CQC Plan (ARCADIS 2012a) as described below.

The CQC Manager performed the Punch-Out Inspection near completion of the RA. The punch list included items remaining on the rework items list that had not been corrected. A copy of the punch list was provided to the RPM, ROICC, and Contracting Officer. The CQC Manager performed follow-up inspections to confirm that all deficiencies were corrected.

The ROICC and CSO representative performed the Pre-Final Inspection to verify that the RA has been constructed satisfactorily according to the ARCADIS Quality Control Program. A Pre-Final punch list was developed as a result of this inspection. The CQC Manager completed all items on this list and provided notification to the Navy for a final inspection.

The Final Acceptance Inspection was conducted by the ROICC and CSO representative based on the results of the Pre-Final Inspection.

3.11.2.1 Federal Facility Agreement Regulatory Agency Inspection

A FFA regulatory agency inspection of the completed durable cover remedy was performed on December 18, 2013. In addition to Navy and ARCADIS staff, the following regulatory agency personnel attended the inspection.

- Craig Cooper – USEPA

- Ryan Miya – Department of Toxic Substances Control (DTSC)
- Ross Steenson – Regional Water Quality Control Board

The inspection consisted of a site walk, and the features of the durable cover were inspected for meeting the requirements of the RD and the ROD. The durable cover was inspected including representative areas of the various new pavement construction types. Drainage features and stormwater BMPs that have been implemented for control of lead based paint were inspected. Representative buildings were entered and crack and foundation repairs were inspected. No regulatory comments regarding deficiencies of the durable cover were received.

3.11.3 Post-Construction (As-Built) Topographic Site Survey

All site surveying was conducted to an accuracy of 0.1 foot horizontally and 0.01 foot vertically (Appendix H). All horizontal coordinates were based on the following surveying control datum: (basis of bearings) North American Datum 27 Zone-III (Hunters Point West 1 PID HT0613). All vertical elevations were based on the following surveying control datum: (benchmark) National Geodetic Vertical Datum 29 (corrected).

Two settlement monuments were installed on the final cover at the locations specified in the RD. Surveyors recorded monument locations and elevations on medallions affixed to the settlement monuments after they were installed. The settlement monuments will be surveyed in accordance with the O&M Plan to assess the magnitude of settlement of the durable cover, if any, during the O&M period.

3.12 Deviations and Modifications

Construction was performed in accordance with the RD (ChaduxTt 2010a) and the RAWP (ARCADIS 2012a), with the exception of three deviations discussed in this section.

As previously discussed in Section 3.5, during initial visits to the site it was observed that the drainage swales terminated immediately south of the Parcel G boundary, which was not addressed in the RD. To maintain continuity of the drainage from the site, culverts and inlet structures were added at the downgradient ends of the four swales.

Additionally, a 3-inch layer of shot-crete was installed over the four north-south drainage swales themselves rather than the AC surface proposed in the RD. Use of shot-crete allowed for faster construction using less materials without sacrificing the protectiveness of the remedy. Appendix B contains a photographic field log of the construction activities performed at the site including installation of the shot-crete.

Compaction of the subgrade was also modified from the RD. The RD specified 95 percent compaction of the subgrade of the maximum dry density, whereas a 90 percent compaction was accepted during the construction of the durable cover over non-roadway portions of the site. This modified compaction was used during construction as a result of the heterogeneity of the soil across the site, making achieving higher compaction difficult. The compaction of 90 percent is consistent with similar constructions and the protectiveness of the durable cover was not reduced as a result.

4. Groundwater Treatment Remedial Action

The groundwater treatment fulfilled the Parcel G active treatment component of the groundwater remedy and RAOs by treating groundwater to reduce concentrations of VOCs and removing the source of contamination (Alliance Compliance Group 2010). As part of the BGMP, groundwater monitoring wells at Parcel G are currently sampled for VOCs and metals to confirm that the groundwater RAOs continue to be met (CE2-Kleinfelder 2012 and 2013a).

4.1 Groundwater Treatment Project Overview

The COCs in groundwater at Parcel G that pose a potential risk to human health based on current and potential future land uses are: chloroform, methylene chloride, TCE, benzene, carbon tetrachloride, naphthalene, PCE, xylene (total), arsenic, chromium VI, and nickel (Navy 2009). The Navy conducted a treatability study at Parcels G and D-1 in 2008 to evaluate technologies to address COCs in groundwater (Alliance Compliance Group 2010).

Five separate groundwater plumes containing VOCs and metals were assessed in 2008 originating on Parcel G for implementation of groundwater treatment through ZVI injection (Figure 4). Screening criteria used for the assessment addressed future commercial/industrial worker exposure to indoor air containing VOCs via soil vapor intrusion, future construction worker exposure to metals in groundwater, and protection of the San Francisco Bay from metals migration in groundwater.

The assessment of metals (arsenic, barium, beryllium, cadmium, chromium, chromium VI, copper, iron, manganese, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc) concentrations in groundwater completed during the treatability study demonstrated that groundwater underlying Parcel G did not exceed the screening criteria and therefore groundwater exposure would not represent a potential risk to future construction workers. The assessment also demonstrated that concentrations in groundwater underlying Parcel G do not exceed criteria for the protection of San Francisco Bay (Alliance Compliance Group 2010). Metals have continued to be monitored under the BGMP since the groundwater treatment program was completed (CE2-Kleifelder 2012).

Based on the assessment completed, two groundwater plumes were identified at Parcel G for ZVI injections – IR-09 North TCE and chromium VI plume and IR-71 West

chloroform plume (Alliance Compliance Group 2010). ZVI injection and sampling results at IR-09 North and IR-71 West are further described in Section 4.2.

In addition to the IR-09 North and the IR-71 West groundwater contaminant plumes, three other plumes (IR-33, IR-71 East, and IR-09 South) were originally identified in the ROD but treatment through ZVI injection was not required based on the results of the soil vapor risk assessment completed as part of the treatability study or alternative source removal actions. These plumes identified in the ROD that were not addressed through ZVI injection are summarized in the following sections.

4.1.1 IR-33 Plume

The soil vapor risk assessment calculated that the maximum cancer risk from the benzene and carbon tetrachloride plume for a commercial/industrial worker under a vapor intrusion to indoor air scenario was below the target risk threshold. In addition benzene had shown declining concentration trends and was consistently below remedial goals (RGs). Therefore no ZVI injection treatment was required at the plume (Alliance Compliance Group 2010).

Groundwater monitoring of the IR-33 plume has been ongoing under the BGMP and has included monitoring of three wells (IR33MW64A, IR33MW65A, and IR34MW36A) for carbon tetrachloride and/or chloroform. Monitoring well IR33MW64A is currently monitored for both carbon tetrachloride and chloroform. Chloroform concentrations indicate an erratic trend, with concentrations at times exceeding the RG. Monitoring for carbon tetrachloride had been stable and consistently below the RG; however, the most recent monitoring event showed an increased concentration exceeding the RG. Chloroform is the only COC in downgradient wells IR33MW65A and IR34MW36A, and had not been detected in consecutive sampling events since 2008. Monitoring was discontinued at these two wells in 2012 with concurrence from the BCT. Groundwater monitoring well IR33MW64A will continue to be monitored under the BGMP to confirm that RAOs continue to be met (CE2-Kleinfelder 2012). Groundwater monitoring concentration trends of these wells are included as Appendix A.

4.1.2 IR-71 East Plume

The soil vapor risk assessment calculated that the maximum cancer risk from the PCE and TCE plume for a commercial/industrial worker under a vapor intrusion to indoor air scenario was below the target risk threshold, and therefore no treatment was required at the plume (Alliance Compliance Group 2010).

Groundwater monitoring of the IR-71 East plume has been ongoing under the BGMP and has included monitoring of two wells (IR71MW03A and IR71MW04A) on Parcel G. Monitoring of both wells has been conducted for chloroform, PCE, and TCE. Samples collected from IR71MW04A since 2006 have been below RGs and generally below detection limits in recent sampling events. Samples collected from IR71MW03A for PCE and TCE have generally been greater than the respective RGs with a decreasing trend observed since about 2009. Concentrations of chloroform exceeded the RG in 2009, but have remained below the RG in all sampling events since that time. Groundwater at these wells will continue to be monitored under the BGMP in accordance with the ROD to confirm that RAOs continue to be met (CE2-Kleinfelder 2012). Groundwater monitoring concentration trends of these wells are included as Appendix A.

4.1.3 IR-09 South Plume

The former pickling vault located at IR-09 located south of Buildings 402 was removed in 2010 to address a plume at IR-09 that contained chromium VI. Approximately 31,000 pounds of ZVI was placed in the excavation following the removal (Tetra Tech 2010). Monitoring well IR09MW64A was installed in the area to replace IR09PPY1 and has been sampled five times for analysis of chromium VI from 2010 to 2013 following the vault removal. Groundwater concentrations of chromium VI were originally near to the screening criteria in IR09PPY1 before the vault removal, and concentrations have been reduced following the source removal in IR09MW64A to significantly below the trigger level and indicate a decreasing trend through 2013. The chromium VI concentration trend graph for IR09PPY1/IR09MW64A is included in Appendix A, and groundwater monitoring will continue under the BGMP (CE2-Kleinfelder 2013b). The other portions of the larger IR-09 TCE plume were included in the ZVI injection treatment, which is discussed further in Section 4.2. Chromium VI concentrations in the other wells of the larger plume area have consistently been below the trigger levels.

4.2 Groundwater Zero Valent Iron Injection

Pneumatic fracturing and injection of over 148,000 pounds of ZVI into 97 injection points was conducted from October to December 2008 at the IR-09 North TCE and IR-71 West chloroform plumes. A post-injection soil vapor and groundwater assessment was conducted from December 2008 to April 2009 (2, 6, 12, and 18 weeks after injection) to assess the effectiveness of ZVI in reducing the TCE soil vapor and groundwater concentrations in IR-09 and the chloroform soil vapor and groundwater concentrations in IR-71.

Complete data results and analyses are included in the Final Parcels D-1 and G Groundwater Treatability Study Technical Report, IR-09, IR-33 and IR-71 (Alliance Compliance Group 2010). Since the completion of the groundwater treatment, groundwater monitoring has been conducted under the BGMP to confirm that the RAOs and requirements of the ROD continue to be met (CE2-Kleinfelder 2012). The results of the injection, post-treatment monitoring, and the subsequent groundwater monitoring conducted under the BGMP are summarized below for each of the plumes treated and the pre-treatment and post-treatment groundwater sampling result trend graphs are included in Appendix A.

4.2.1 IR-09 North Plume Treatment

Groundwater ZVI injection at IR-09 North was completed in 2008. TCE was the only VOC detected exceeding a groundwater screening criterion during pre-injection monitoring. Chromium VI exceeded the groundwater screening criteria but was addressed through removal of the pickling vault (see Section 4.1.3) rather than ZVI injection. Post-injection monitoring of the plume following treatment indicated the following:

- Overall TCE concentrations in groundwater reduced by an average of 87 percent following treatment.
- All measured TCE concentrations in shallow groundwater were below groundwater remediation goals during the final post-injection sampling event conducted in March 2009.
- Deep groundwater at IR-09 still contained TCE at concentrations above the groundwater remediation goal. Because shallow groundwater concentrations are below the remediation goal, deeper groundwater TCE concentrations did not represent a vapor intrusion risk to indoor air and further treatment was not conducted.

Concentrations of VOCs in groundwater were below the remedial goals established in the ROD following ZVI injection, except for one area (at well IR09MW07A) in the deeper part of the A aquifer at IR Site 9. Groundwater samples from the shallower portion of the A-aquifer at this location in IR Site 9 (IR09MW51F) were below remedial goals for TCE immediately following treatment (Alliance Compliance Group 2010). The Navy decided, with concurrence from the BCT, not to continue to treat the deeper portions of the A-aquifer because the risk related to VOCs in groundwater was based

on migration of volatile chemicals to indoor air, and the treatability study concluded that the associated risk to a commercial/industrial worker in this scenario was less that the target risk threshold. Continued groundwater monitoring conducted at IR09MW07A through the BGMP following the ZVI injection has shown a downward concentration trend (Appendix A) and the concentration has been below the RG in recent sampling conducted in 2013 (CE2-Kleinfelder 2013a and b).

Ongoing sampling has been conducted at the IR-09 combined north and south plume (see Section 4.1.3 regarding the IR-09 South plume chromium VI source removal) following ZVI injection under the BGMP from seven monitoring wells (IR09MW63A, IR09MW07A, IR09MW51F, IR09MW37A, IR09MW38A, and IR09P040A). Monitoring wells IR09MW63A, IR09MW37A, and IR09MW38A were sampled from 2006 through 2012 for chromium VI and never exceeded the trigger value. The BGMP optimization evaluation recommended eliminating the wells from further sampling (CE2-Kleinfelder 2012), and the BCT representatives concurred with the recommendation.

Groundwater monitoring conducted at IR09MW07A was continued under the BGMP for primarily chromium VI, chloroform, and TCE. Chromium VI was significantly less than the trigger value and chloroform was less than the RG and non-detect. As has been previously described, concentrations of TCE had exceeded the RG after the ZVI injection, but have more recently been below the RG with a decreasing trend (Appendix A). Groundwater monitoring frequency at this well has been reduced from semiannual to biennial because of the results and trends observed.

Groundwater monitoring conducted at IR09MW51F was continued under the BGMP for chromium VI, benzene, and TCE. Concentrations of chromium VI have always been below the trigger level and have been consistently non-detect following ZVI injection. Concentrations of benzene exceeded the RG following the ZVI injection, but have been below the RG since 2010. Concentrations of TCE exceeded the RG prior to the ZVI injection and have been below RGs following the injection. Concentrations of chromium VI, benzene, and TCE in the four or more recent sampling events are all less than the trigger level or RG (Appendix A). Groundwater monitoring has been discontinued at this well following the samples collected in 2012 in accordance with the recommendations of the BGMP optimization evaluation (CE2-Kleinfelder 2012).

Groundwater monitoring conducted at IR09P040A was continued for analysis of chloroform under the BGMP. Concentrations briefly exceeded the RG in 2008 and 2009 and have been below the RG since that time and has been non-detect since 2010 (Appendix A). The BGMP optimization evaluation recommended eliminating the

well from further sampling (CE2-Kleinfelder 2012), and the BCT representatives concurred with the recommendation.

Recent groundwater monitoring at the IR-09 North plume has confirmed that all remaining COCs in groundwater are below their respective RGs or trigger levels. As a result groundwater monitoring at all but one well associated with the VOC plume has been discontinued under the BGMP with BCT concurrence. Groundwater monitoring will continue under the BGMP at IR09MW07A to confirm that RAOs continue to be met. In addition, groundwater monitoring will continue under the BGMP at IR09MW64A associated with the IR-09 South chromium VI plume (see Section 4.1.3).

4.2.2 IR-71 West Plume Treatment

Groundwater ZVI injection at IR-71 West was completed in 2008. Chloroform was the only VOC detected exceeding a groundwater screening criterion during pre-injection monitoring. Post-injection monitoring indicated the following:

- Chloroform concentrations in soil vapor reduced by an average 72 percent and by an average of 98 percent in groundwater following treatment.

- All measured chloroform concentrations in groundwater were below groundwater remediation goals during the final post-injection sampling events in March and April 2009.

The post-injection results from the treatability study showed strong declining trends in concentrations of VOCs in groundwater and soil gas. Ongoing sampling has been conducted at the IR-71 West plume following ZVI injection under the BGMP from three Parcel G monitoring wells (IR33MW121B, IR44MW08A, and IR33MW63A). Monitoring wells IR33MW121B (vinyl chloride) and IR33MW63A (chloroform) were sampled through 2012. Concentrations following ZVI injection were non-detect for vinyl chloride in all sampling events and were below RGs or non-detect for chloroform. The BGMP optimization evaluation recommended eliminating the wells from further sampling (CE2-Kleinfelder 2012), and the BCT representatives concurred with the recommendation.

Groundwater monitoring conducted at IR44MW08A was continued under the BGMP for chloroform and TCE. Chloroform exceeded the RG prior to ZVI injection and has been below the RG since that time and non-detect in the most recent samples collected. Concentrations of TCE have remained below the RG in all samples collected both prior

and following ZVI injection (Appendix A). Concentrations of both chloroform and TCE indicate stable trends and monitoring of the well under the BGMP has been discontinued following the samples collected in 2012 in accordance with the recommendations of the BGMP optimization evaluation (CE2-Kleinfelder 2012).

Recent groundwater monitoring at the IR-71 West plume has confirmed that all remaining COCs in groundwater are below their respective RGs and RAOs are being met. As a result groundwater monitoring in the area has been discontinued under the BGMP with BCT concurrence (CE2-Kleinfelder 2012).

4.3 Continued Basewide Groundwater Monitoring at Parcel G

The ongoing groundwater monitoring program at Parcel G is conducted in accordance with the Final D-1 and G Groundwater Treatability Study Technical Report, IR-09, IR-33, and IR-71 (Alliance Compliance Group 2010) and the Final Remedial Action Monitoring Plan, Parcel G (ChaduxTt 2010a). The groundwater monitoring addresses potential migration of COCs in groundwater and changes in concentrations within the identified groundwater contaminant plumes at Parcel G including the plumes addressed through the groundwater treatability study.

The Final Technical Memorandum for Monitoring Program Optimization in Parcels B. D-1, G, and UC-2 (CE2-Kleinfelder 2012), with the approval of the regulatory agencies, has reduced the number of monitoring wells that are currently monitored under the BGMP at Parcel G because contaminant concentrations at most wells are less than remedial goals and concentrations have been stable or decreasing. Monitoring wells where contaminant concentrations exceed remedial goals continue to be monitored under the BGMP and in accordance with the ROD. The most recent Parcel G groundwater monitoring results from the BGMP are described below and are included on Figure 4.

4.3.1 Groundwater Monitoring July – December 2012

During the monitoring period from July to December 2012 groundwater samples were collected from five wells at Parcel G (IR09MW51F, IR09MW64A, IR44MW08A, IR71MW03A, and IR71MW04A). Groundwater concentrations exceeded remedial goals in one well (IR71MW03A at the IR-71 East plume) for PCE and TCE. Concentrations of PCE and TCE have consistently exceeded the remedial goals since 2009 at IR71MW03A; however, concentrations during the monitoring period were below the historical maximum concentrations (See Appendix A and discussion of the

IR-71 East plume in Section 4.1.2). All other contaminant concentrations were below remedial goals. Groundwater analytical results from the recent BGMP sampling events are summarized on Figure 4 and are included in the trend graphs in Appendix A.

4.3.2 Groundwater Monitoring January – June 2013

During the monitoring period from January to June 2013 groundwater samples were collected from five wells at Parcel G (IR09MW07A, IR33MW64A, IR71MW03A, IR71MW04A, and IR09MW64A). Groundwater concentrations exceeded remedial goals in two wells (IR33MW64A at the IR-33 plume and IR71MW03A at the IR-71 East plume). IR33MW64A had two exceedances of the remedial goal for carbon tetrachloride and chloroform. Carbon tetrachloride had not exceeded the remedial goal during the sampling events conducted since 2009 and chloroform was below the remedial goal in the preceding sampling event. IR71MW03A had one exceedance of the remedial goal for PCE, but this concentration was a new historical low in the monitoring well. TCE, which exceeded the remedial goal in the preceding sampling event, was below its remedial goal in the more recent sampling event. All other contaminant concentrations were below remedial goals. Groundwater analytical results from the recent BGMP sampling events are summarized on Figure 4 and in Appendix A.

5. Institutional Controls

In accordance with the ROD (Navy 2009), ICs are components of both the soil and groundwater remedies for Parcel G. ICs are legal and administrative mechanisms used to implement land use restrictions that are used to limit the exposure of future landowner(s) or user(s) of the property to hazardous substances present on the property, and to ensure the integrity of the remedial action. ICs are required because the selected remedial cleanup levels result in contamination remaining at the property above levels that allow for unlimited use and unrestricted exposure. ICs will be maintained until the concentration of hazardous substances in soil and groundwater are at such levels to allow for unrestricted use and exposure. Implementation of ICs includes requirements for monitoring and inspections, and reporting to ensure compliance with land use or activity restrictions.

ICs, including restricted and prohibited activities, have been implemented at Parcel G to prevent exposure to areas where there is potential unacceptable risk posed by COCs in soil and groundwater. The LUC RD (ChaduxTt 2010a) addresses the ICs and land use restrictions required by the ROD (Navy 2009). Parcel G is currently owned by the Navy and is not subject to lease. The LUC objectives described in the LUC RD are being met and will continue to be met through site access controls. Operation and maintenance inspections of the final remedy at Parcel G will occur quarterly for the first year following completion of the durable cover and at least annually thereafter. These inspections include completion of an IC Compliance Monitoring Report to verify that ICs are being implemented (see also Section 6.3 Land Use Controls).

IC restrictions will be incorporated into two separate legal documents at the time of transfer: (1) quitclaim deed(s) and (2) covenants to restrict use of property to ensure continued implementation.

As described in the ROD, the entire area of Parcel G has been included in the ARIC. The individual portions of Parcel G subject to ICs related to VOC vapors in soil have been defined through soil gas surveys (Figure 5).

5.1 Institutional Controls Performance Objectives

IC Performance objectives were developed and presented in the ROD (Navy 2009) and the LUC RD (ChaduxTt 2010a) and are intended to limit exposure of future users of the property to hazardous substances and to maintain the integrity of the remedy.

The IC performance objectives to be implemented through land use restrictions for the site include:

1. Site wide prohibition for growing edible items in native soil for human consumption and use of groundwater,
2. Land use is restricted for property areas designated for open space, educational/cultural, and industrial in the reuse plans unless prior written approval is granted by the FFA signatories. Restricted land uses include residences, hospitals, schools, and day care facilitates.
3. Activities are restricted throughout the Parcel G property without prior FFA signatory approval including land disturbing activity; alteration, disturbance, or removal of any component of a remedy or response cleanup action; extraction of groundwater or installation of new groundwater wells (unless necessary or required by the CERCLA remedy); removal or damage of security features; and construction of enclosed structures where VOC vapor exposure may pose an unacceptable risk.

Greater detail regarding these land use restrictions and their implementation are included in the ROD (Navy 2009) and the LUC RD (ChaduxTt 2010a).

5.2 Legal Mechanisms Following Conveyance

The LUC objectives for Parcel G are being met by the Navy through access controls until time of transfer. Each transfer of fee title from the United States to a non-federal entity will include a description of the residual contamination on the property and the environmental use restrictions, expressly prohibiting activities inconsistent with the performance measure goals and objectives. Each deed will also contain a reservation of access to the property for the Navy, the FFA signatories, and their respective officials, agents, employees, contractors, and subcontractors for purposes consistent with the Navy IR Program or the FFA. The deed will contain appropriate provisions to ensure that the restrictions continue to run with the land and are enforceable by the Navy. The Navy will meet the statutory requirements of CERCLA Section 120(h)(3) for any transfer of fee title.

The following two proprietary legal mechanisms will incorporate and be relied upon to implement the IC objectives and land use restrictions when the property is conveyed to a non-federal entity. The mechanisms shall remain in effect until otherwise terminated through demonstration that one or more of the restrictions is no longer needed for protection of human health and the environment.

1. Restrictive covenants included in one or more Quitclaim Deeds from the Navy to the property recipient.
2. Restrictive covenants included in one or more Covenants to Restrict Use of Property entered into by the Navy and DTSC as provided in the Navy/DTSC Memorandum of Agreement (Navy and DTSC 2000) and consistent with the substantive provisions of California Code of Regulations Title 22, Section 67391.1.

The Covenant to Restrict Use of Property will incorporate the land use restrictions into environmental restrictive covenants that run with the land and that are enforceable by DTSC and USEPA against future transferees and users. The Quitclaim Deed will include the identical land use and activity restrictions in environmental restrictive covenants that run with the land and that will be enforceable by the Navy against future transferees.

ICs will be maintained until the concentration of hazardous substances in soil and groundwater are at such levels as to allow for unrestricted exposure.

The Navy is responsible for implementing, maintaining, reporting on, and enforcing the land use controls. The Navy intends to transfer the procedural responsibilities to OCII. Although the Navy may transfer the procedural responsibilities to OCII, the Navy will retain ultimate responsibility. The Navy continues to monitor IC performance and monitor that RAOs are being met through the O&M process and annual inspections as specified in the LUC RD and required in the ROD (ChaduxTt 2010a, Navy 2009).

6. Ongoing Activities

Ongoing activities associated with the remedy at Parcel G include O&M and monitoring of the durable cover, groundwater monitoring conducted under the BGMP, and implementation and monitoring of the LUCs. The following sections describe each of these ongoing activities.

In addition to the ongoing activities directly related to Parcel G, five-year reviews have been ongoing at HPNS to monitor the effectiveness of the remedial actions taken at the various parcels and including Parcel G. The third five-year review conducted under CERCLA at HPNS was completed in November 2013 and included an analysis of the Parcel G remedies. The review was conducted in accordance with the Navy and Marine Corps Policy for Conducting CERCLA Statutory Five-Year Reviews (Navy 2011) and the USEPA Comprehensive Five-Year Review Guidance (USEPA 2001, 2011, 2012).

The purpose of the Five-Year reviews is to evaluate the performance of the remedies implemented at HPNS to verify that they remain protective of human health and the environment. The recent five-year review concluded that the final remedy for Parcel G is expected to be protective of human health and the environment upon completion and that other remedial activities completed have adequately addressed all exposure pathways that could result in unacceptable risks. At the time of the five-year review the cover was being constructed and the effectiveness of the cover will be assessed in the next five-year review. The next five-year review of HPNS will be completed in 2018.

6.1 Maintenance and Monitoring of Durable Covers

Maintenance and monitoring of the remedy implemented at Parcel G were started following completion of the RA in July 2013 and are ongoing. Maintenance and monitoring of the remedy has been initially implemented in accordance with the pre-construction O&M Plan (ChaduxTt 2010a). Long-term maintenance and monitoring will be performed in accordance with the post-construction O&M Plan being developed in parallel with this RACR. The O&M Plan describes the long-term maintenance and monitoring requirements for the durable covers at Parcel G, thus it fulfills the substantive requirements of the applicable or relevant and appropriate requirements related to maintenance and monitoring for durable covers in the ROD (Navy 2009).

The O&M Plan includes:

- A description of inspection, maintenance, and repair of the durable covers
- A list and copies of the manufacturers cut sheets
- As-built construction drawings and O&M-related specifications
- A maintenance schedule
- Guidance for inspection of signs, drainage features, final grade, and the condition of the durable covers
- Potential repair procedures that may be necessary during the life of the covers
- Reporting requirements

The first O&M inspection of the durable cover was conducted in the 4th quarter of 2013 and consisted of an inspection of the general site conditions and site security, assessment of the durable cover and stormwater drainage features, and assessment of the monitoring wells. All repairs and actions taken as part of the O&M inspection were consistent with anticipated general maintenance and not indicative of a remedy insufficiency.

Some site security and site access issues were observed consisting of alteration of fencing and security gates, which were remedied during the inspection. Durable cover surface repairs were conducted where cracks and minor voids in the asphalt pavement or drainage swales were identified. These repairs included small isolated areas of the asphalt pavement cover in the vicinity of the scale on the northwestern portion of the site that had collapsed exposing the underlying concrete vault. Trash and vegetation were removed from the site as needed. All monitoring wells were observed to be intact and in good condition, and some wells had been decommissioned as part of the BGMP. The train scale and underlying vault located on the northwestern portion of the property was inspected to confirm that it meets requirements of a durable cover and prevents contact with the underlying soil. The vault underlying the train scale is constructed of concrete and thus prevents access to underlying soil and potential COCs. IC compliance monitoring was also completed as part of the O&M inspection as described in Section 6.3.

6.2 Groundwater Monitoring

Groundwater monitoring is ongoing under the existing BGMP. Periodic monitoring reports are published that describe the monitoring results and compare the results to the RAOs established in the ROD (Navy 2009). Groundwater monitoring will continue to verify that RAOs for groundwater are being met.

6.3 Land Use Controls

The ROD requires implementation of land use restrictions to reduce exposure of future landowners or users of the property to hazardous substances and to maintain the integrity of the remedy (Navy 2009). The LUC objectives will be met by controlling access to the property until the time of property transfer.

The LUC RD specifies all land use and activity restrictions, and these restrictions will be incorporated into the covenant to restrict use of property and deed(s) and will take effect upon transfer to OCII and be enforceable for all future property owners.

Throughout the O&M period, inspections will be performed on at least an annual basis to verify that the requirements specified in the IC Compliance Monitoring Report are met (ChaduxTt 2010a). ICs are currently being implemented by the Navy by regular inspections and documented in the IC Compliance Monitoring Report that accompanies the O&M reports. IC restrictions will be incorporated into two separate legal documents at the time of transfer: (1) quitclaim deed(s) from the Navy to the property recipient and (2) covenants to restrict use of property entered between the Navy and DTSC to ensure continued implementation.

The first IC compliance monitoring was completed in October 2013 as part of the O&M inspection process. All land use controls were observed to be in compliance, and there were no unauthorized uses or land disturbance activities identified. Security features, including fencing and site vehicle access gates, were observed to have been tampered with and were replaced to the original condition during the inspection. Although there was indication that the site had been accessed potentially by unauthorized individuals, there was no indication that access resulted in exposure to underlying soil or groundwater.

6.4 Demonstration of Completion

The RA is deemed to be complete when all the RAOs are met. Table 4 summarizes the RAOs for Parcel G and how they were achieved through proper implementation and satisfactory completion of the durable cover and groundwater treatment final remedies, and will continue to be achieved through groundwater monitoring conducted under the BGMP and implementation of the O&M Plan and ICs.

7. Community Relations

Prior to the start of work, the RAWP was made available to the public at two local repositories – the CCSF Main Library and the HPNS Library (located in the Bayview/Hunters Point community).

Community meetings were held on April 24 and June 26, 2013 to describe the nature of the remedy selected for Parcel G, to update the community on the progress of the RA work being performed, to inform the community about the monitoring and protective measures being implemented to protect nearby residents and the local environment throughout the RA, and to allow the community to ask questions or express concerns about implementation of the RA. In addition, all meeting attendees were invited to join a smaller group session to discuss and ask questions about the RA being performed with the Navy and the regulatory agencies. A bus tour was also conducted on August 24, 2013 to allow community members to observe the remedy implementation at Parcel G. A Fact Sheet will be created to describe the work performed as part of the RA and to document successful completion of the RA. The fact sheet is included as Appendix I and will be distributed electronically and in hard copy to the HPNS community mailing list following final acceptance of this RACR. The HPNS distribution list contains approximately 2,500 recipients.

8. Project Costs

The approximate costs to perform the durable cover RA, not including elements not directly related to the remedy construction, are provided below. It should be noted that the cost summary below does not include the cost associated with maintenance and monitoring of the remedy.

Project Element	Cost
Pre-Construction Documents	$54,600
Construction Mobilization, Demobilization, and Site Preparations	$464,000
Durable Cover Construction	$2,678,000
Post-Construction Documents	$55,600
Total	$3,252,200

The approximate costs to perform the groundwater treatment RA, not including elements not directly related to the remedy construction and implementation, are provided below.

Project Element	Cost
Pre-Injection Assessment	$1,800,000
ZVI Injection Program	$2,200,000
Post Injection Assessment	$900,000
Total	$4,900,000

9. Certification Statement

I certify that this RACR memorializes the completion of activities to implement the durable cover, groundwater treatment, and IC portions of the RA at Parcel G at the former HPNS. These RAs were implemented pursuant to the ROD for Parcel G (Navy 2009), and in accordance with the RD for Parcel G (ChaduxTt 2010a), Work Plan for the Groundwater Treatability Study, IR-09, IR-33, and IR-71 (Alliance Compliance Group 2008), and the Final RAWP (ARCADIS 2012a). No additional construction activities for remediated areas are anticipated at this time, thus the RA is deemed complete. Maintenance and monitoring of the durable cover remedy will be performed in accordance with the Pre-Construction O&M Plan (ChaduxTt 2010a) until the Post-Construction O&M Plan is finalized in February 2014. Groundwater monitoring is ongoing and managed under the BGMP. The LUC objectives will be met using access controls and signs until the time of property transfer. The activities and land use restrictions described in the LUC RD Report (ChaduxTt 2010a) will be incorporated into the Quitclaim Deed and Covenant to Restrict Use of Property and will take effect upon transfer and issuance of those documents.

3/24/14

Mr. Keith Forman
BRAC Environmental Coordinator
Hunters Point Naval Shipyard

10. References

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Program Management Office West Naval
Facilities Engineering Command

Air Monitoring Summary Report Remedial Action for Parcel G, Hunters Point Naval Shipyard, San Francisco, California

Contract: N62473-11-D-2226, PTO 0002

March 2013

ARCADIS

Air Monitoring Summary Report

Remedial Action for Parcel G,
Hunters Point Naval Shipyard,
San Francisco, California

Ron Goloubow, PG
Principal Geologist

Prepared for:
Base Realignment and Closure
Program Management Office West Naval
Facilities Engineering Command
1455 Frazee Road, Suite 900
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Prepared by:
ARCADIS U.S., Inc.
2000 Powell Street #700
Emeryville, CA 94608

Our Ref.:
CA000776

Date:
March 2013

Figures

Tables

Appendices

Acronyms and Abbreviations

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BRAC	Base Realignment and Closure
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HPNS	Hunters Point Naval Shipyard
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
PM10	particulate matter less than 10 microns in diameter
TSP	total suspended particles
USEPA	U.S. Environmental Protection Agency

1. Introduction

ARCADIS-US, Inc. (herein after referred to as ARCADIS) is providing environmental remediation services to the U.S. Department of the Navy under the Contract: N62473-11-D-2226, PTO 0002. ARCADIS is performing air monitoring at Hunters Point Naval Shipyard (HPNS) in accordance with the Final Dust Control Plan (DCP), included as Appendix D to the Remedial Action Work Plan for Parcel G, Hunters Point Naval Shipyard, San Francisco, California (ARCADIS 2012). The DMP described procedures that minimized dust during work activities, and required air monitoring to ensure these procedures were effective. The DMP helped prevent exposure of residents and construction crews to potential airborne chemicals of concern, and dust from the work area.

This document summarizes the perimeter air monitoring data collected and analyzed for this project. This summary report describes the following:

- Where and how air monitoring samples were collected
- What test methods were used to analyze air monitoring samples
- How air monitoring data were evaluated

This summary report also presents the air monitoring test results and compares the results with the established threshold criteria included in the DMP.

2. Monitoring Site Locations

Air monitoring stations were mobilized to collect air samples upwind and downwind of work areas for the duration of the project. The predominant wind direction at HPNS is from the west.

Locations of air monitoring stations and wind direction are shown on Figure 1. Air monitoring was performed to ensure effective dust control. The locations of the air monitoring stations were determined based on the prevailing wind direction and were modified as needed. A windsock was used to show wind direction and atmospheric parameters were checked daily at www.wunderground.com (see Appendix A; Table A-1). Atmospheric data provided by www.wunderground.com was collected from station KCASANFR58. Monitoring stations remained stationary while sampling was conducted. In accordance with the DMP, air monitoring samples are collected on a filter from each air monitoring station that operates for a maximum of 24-hours.

Each monitoring station included four separate monitoring systems for:

1. Total suspended particulates (TSP) and for arsenic, lead, and manganese
2. Particulate matter larger than 10 microns in size (PM10)
3. Asbestos

3. Analytical Methods

TSP, Arsenic, Lead, and Manganese. TSP samples were collected with a high-volume (39 to 60 cubic feet per minute) air sampler in accordance with U.S. Environmental Protection Agency's (EPA's) reference sampling method for TSP, described in Title 40 Code of Federal Regulations (CFR), Part 50; Appendix B. Each sample was collected on a filter over an approximately 24-hour period; the filter was then weighed to determine the amount of TSP collected.

Once the amount of TSP was determined, the sample was analyzed for arsenic, lead, and manganese. Arsenic, lead, and manganese were analyzed using a modified EPA Method 6020 (EPA SW846; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its Updates.) The equipment specifications and sampling procedures used, including the sampling apparatus, filters, equipment accuracy, equipment calibration, and quality assurance checks, all conformed to those specified in the analytical method.

PM10. Air samples were collected and analyzed for PM10 in accordance with EPA's reference sampling method for PM10, described in 40 CFR Part 50, Appendix J. Each sample was collected on a filter over an approximately 24-hour period; the filter was then weighed to evaluate the concentrations of PM10 in ambient air.

Asbestos. Air samples were collected and analyzed for asbestos in accordance with the National Institute for Occupational Safety and Health (NIOSH) Method 7400, in the NIOSH Manual of Analytical Methods (NIOSH 1994). Method 7400 required that samples be collected on three piece cellulose ester filters, which were fitted with conductive cowlings, at a sampling rate of between 0.5 liter per minute (L/min) and 16 L/min.

4. Analysis of Air Monitoring Data

Analytical results from air monitoring samples were compared with the threshold criteria listed in Table 1. Construction activities did not result in the exceedances of the established threshold criteria at any time during project execution.

5. Air Monitoring Results

Weather information (including ambient pressure and temperature data) and air monitoring results are presented in the tables included as Appendix 1.

6. References

NIOSH (National Institute for Occupational Safety and Health). 1994. NIOSH Manual of Analytical Methods, Method 7400. August.

ARCADIS. 2012 Final Work Plan Remedial Action Work Plan for Parcel G, Hunters Point Naval Shipyard, San Francisco, California. December.

Table 1 - Threshold Criteria for Analysis of Air Monitoring Data

Test Parameter	Threshold Criterion	Threshold Criteria Reference
TSP	0.5 mg/m^3	Calculated action level for general dust and particulates
Arsenic	10 $\mu g/m^3$	Cal/OSHA PEL[1]
Lead	50 $\mu g/m^3$	Cal/OSHA PEL
Manganese	200 $\mu g/m^3$	Cal/OSHA PEL
Asbestos	0.1 $fibers/cm^3$	Cal/OSHA PEL
PM_{10}	5,000 $\mu g/m^3$	Cal/OSHA PEL

Notes:

[1] - Cal/OSHA PEL for particulates not otherwise regulated (respiratory) used for PM_{10}
Cal/OSHA = California Division of Occupational Safety and Health Administration
cm^3 = cubic centimeter
mg/m^3 = milligrams per cubic meter
NIOSH = National Institute of Occupational Safety and Health
PEL = permissible exposure limit
PM_{10} = particulate matter less than 10 microns in diameter
TSP = total suspended particulates
$\mu g/m^3$ = micrograms per cubic meter

Table 1-1
Ambient Pressure and Temperature Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Ambient Pressure (in Hg)	Ambient Temperature (°F)
2/19/2013	29.94	66.2
2/20/2013	29.95	73.4
2/21/2013	30.06	72.1
2/22/2013	30.15	72.9
2/25/2013	30.16	71.1
2/26/2013	30.11	72.7
2/27/2013	30.26	73.6
2/28/2013	30.35	71.2
3/1/2013	30.32	76.3
3/4/2013	30.05	63.5
3/5/2013	29.97	61.9
3/6/2013	29.96	62.1
3/7/2013	29.89	61.3
3/8/2013	29.94	65.1
3/11/2013	30.16	74.7
3/12/2013	30.06	77.7

Notes:
°F = degrees Fareheit
in Hg = inches of mercury
From Febraury 19, 2013 through March 12, 2013 ovember 14, 2012, ambient pressure and ambient temperature data were gathered from the wunderground weather website (www.wunderground.com). Data were collected from station KCASANFR58.

Table 1-2
Total Suspended Particulates and Metals Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Volume of Air Pumped meters^3	TSP (mg/m^3)	TSP Exceedance? (Yes/No)	Arsenic (µg/m^3)	Arsenic Exceedance? (Yes/No)	Lead (µg/m^3)	Lead Exceedance? (Yes/No)	Manganese (µg/m^3)	Manganese Exceedance? (Yes/No)
2/21/2013	1B	1,444	0.164	No	0.0010	No	0.0194	No	0.0970	No
2/21/2013	2B	1,422	0.042	No	0.0008	No	0.0069	No	0.0218	No
2/26/2013	1B	1,703	0.138	No	0.0011	No	0.0153	No	0.0998	No
2/26/2013	2B	1,677	0.031	No	0.0007	No	0.0034	No	0.0137	No
3/4/2013	1B	1,037	0.121	No	0.0014	No	0.0154	No	0.0781	No
3/4/2013	2B	948	0.062	No	0.0014	No	0.0083	No	0.0295	No
3/7/2013	1B	1,425	0.141	No	0.0009	No	0.0147	No	0.0772	No
3/7/2013	2B	1,403	0.032	No	0.6700	No	3.6000	No	0.0100	No
3/12/2013	1B	1,703	0.130	No	0.0011	No	0.0170	No	0.0881	No
3/12/2013	2B	1,750	0.038	No	0.0006	No	0.0049	No	0.0149	No
Screening Criteria			0.500		10		50		200	

Notes:
Sample locations are shown on Figure 1.
The threshold criteria are as follows: TSP = 0.5 mg/m^3, arsenic = 10 µg/m^3, lead = 50 µg/m^3, manganese = 200 µg/m^3.
The detection limit for TSP is 0.06 µg/m^3 assuming a minimum sample volume of 1,600 m^3. The detection limits for arsenic, lead, and manganese are 16 ng/m^3 assuming minimum sample volumes of 1.600 m^3.
µg/m^3 - micrograms per cubic meter
mg/m^3 - milligrams per cubic meter
N/A - not applicable
ng/m^3 - nanograms per cubic meter
TSP - total suspended particulates
Samples Analyzed by TestAmerica
The screening levels for TSP is the calculated action level for general dust and particulates
Screening Levels for arsenic, lead, and manganese are based on the Cal/OSHA permissible exposure limit.

Table 1-3
Particulate Matter Smaller than 10 microns in Diameter (PM10) Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Identification	Sample Date	Sample Location	Sampling Period (hours)	Volume of Air Pumped in cubic meters	PM10 ($\mu g/m^3$)	PM10 Exceedance? Yes/No
ARC020713-19-1A	2/21/2013	1A	19.0	1,311	57.9	No
ARC020713-18-1B	2/21/2013	2A	19.75	1,369	17.0	No
ARC020713-16-1A	2/26/2013	1A	25.25	1,742	42.1	No
ARC020713-15-1B	2/26/2013	2A	25.25	1,750	13.3	No
ARC020713-12-1A	3/4/2013	1A	18.75	1,294	37.4	No
ARC020713-14-1B	3/4/2013	2A	20.0	1,386	21.7	No
ARCO20713-10-1A	3/7/2013	1A	21.5	1,484	33.5	No
ARCO20713-13-2A	3/7/2013	2A	21.5	1,490	13.3	No
ARCO20713-2-1A	3/12/2013	1A	21.8	1,501	43.4	No
ARCO20713-4-2A	3/12/2013	2A	24.0	1,777	17.9	No

Notes:
Sample locations are shown on Figure 1.

The threshold value for PM10 is 5,000 $\mu g/m^3$ based on the Cal/OSHA permissible exposure limit for particulates not otherwise regulated (respiratory) used for PM10.

The detection limit for PM10 is 0.06 $\mu g/m^3$ assuming a minimum sample volume of 1,600 m^3.
$\mu g/m^3$ - micrograms per cubic meter
PM10 - particulate matter smaller than 10 microns in diameter
Samples Analyzed by TestAmerica

Table 1-4
Asbestos Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Sampling Period (hours)	Volume of air pumped in Liters	Asbestos (fibers/cm^3)	Asbestos Exceedance? Yes/No
2/19/2013	CG472322	24	1,728	< 0.001	No
2/19/2013	CG472623	24	1,728	< 0.001	No
2/26/2013	CG472332-1	24	1,656	<0.002	No
2/26/2013	CG472332-2	24	1,836	<0.001	No
3/1/2013	CG-472903-1	24	1,008	< 0.003	No
3/1/2013	CC-472295-2	24	936	< 0.003	No
3/7/2013	CG472292-1	24	1,548	< 0.002	No
3/7/2013	CG472291-2	24	1,386	< 0.002	No
3/12/2013	CG472384-2	24	1,872	< 0.001	No
3/12/2013	CG472354-1	24	1,697	< 0.002	No

Notes:
Sample locations are shown on Figure 1.
The threshold value for asbestos is 0.1 fibers/cm^3 based on the Cal/OSHA permissible exposure limit.
Reporting limit is calculated using a minimum detection limit of 7 fibers/$millimeter^2$.
fibers/cm^3 - fibers per cubic centimeter
Samples Analyzed by EMLab P&K

ALT. FIRE HYDRANT

PREVAILING WIND DIRECTION

FIRE HYDRANT

401
402
302
303
304
436
435
437
420
419
424
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363
417
366
407
411
351
415
323
324
439
D-A

LEGEND

PARCEL G BOUNDARY

EXISTING AGGREGATE DRAINAGE SWALE WITH FLOW DIRECTION

EXISTING RAILROAD TRACKS

411 EXISTING BUILDING PAD AND FORMER BUILDING NUMBER

AIR SAMPLING STATION

WINDSOCK LOCATION

NOTE:
UPWIND AND DOWNWIND AIR SAMPLING STATIONS MAY BE RELOCATED BASED ON CHANGES IN THE DIRECTION OF PREVAILING WINDS ON PARCEL G AS INDICATED BY THE ON SITE WINDSOCK.

WIND DIRECTION: PER SOUTHWEST NAVAL FACILITIES ENGINEERING COMMAND WIND ROSE PLOTS OF HUNTERS POINT SHIPYARD 08/06/00-10/12/00

0 150' 300'
GRAPHICAL SCALE

NAVAL BASE REALIGNMENT AND CLOSURE PROGRAM
SAN FRANCISCO, CALIFORNIA
PARCEL G, HUNTERS POINT NAVAL SHIPYARD
DUST CONTROL PLAN

REAL-TIME AIR MONITORING

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FIGURE
1

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Air Monitoring Summary Report Remedial Action for Parcel G, Hunters Point Naval Shipyard, San Francisco, California

Contract: N62473-11-D-2226, PTO 0002

April 2013

ARCADIS

Ron Goloubow, PG
Principal Geologist

Air Monitoring Summary Report

Remedial Action for Parcel G, Hunters Point Naval Shipyard, San Francisco, California

Prepared for:
Base Realignment and Closure
Program Management Office West Naval
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Prepared by:
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2000 Powell Street #700
Emeryville, CA 94608

Our Ref.:
CA000776

Date:
April 2013

Figures

Tables

Appendices

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Navy	United States Department of the Navy
PM10	particulate matter less than 10 microns in diameter
TSP	total suspended particles
USEPA	U.S. Environmental Protection Agency

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- What test methods were used to analyze air monitoring samples
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Each monitoring station included three separate sample/filter media for:

1. Total suspended particulates (TSP) and for arsenic, lead, and manganese
2. Particulate matter larger than 10 microns in size (PM10)
3. Asbestos

3. Analytical Methods

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PM10. Air samples were collected and analyzed for PM10 in accordance with EPA's reference sampling method for PM10, described in 40 CFR Part 50, Appendix J. Each sample was collected on a filter over an approximately 24-hour period; the filter was then weighed to evaluate the concentrations of PM10 in ambient air.

Asbestos. Air samples were collected and analyzed for asbestos in accordance with the National Institute for Occupational Safety and Health (NIOSH) Method 7400, in the NIOSH Manual of Analytical Methods (NIOSH 1994). Method 7400 required that samples be collected on three piece cellulose ester filters, which were fitted with conductive cowlings, at a sampling rate of between 0.5 liter per minute (L/min) and 16 L/min.

4. Analysis of Air Monitoring Data

Analytical results from air monitoring samples were compared with the threshold criteria listed in Table 1. Construction activities did not result in the exceedances of the established threshold criteria at any time during project execution.

5. Air Monitoring Results

Weather information (including ambient pressure and temperature data) and air monitoring results are presented in the tables included as Appendix 1.

6. References

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PARCEL G, HUNTERS POINT NAVAL SHIPYARD
DUST CONTROL PLAN

REAL-TIME AIR MONITORING

ARCADIS

FIGURE
1

ARCADIS

Attachment 1
Air Monitoring Results

Table 1 - Threshold Criteria for Analysis of Air Monitoring Data

Test Parameter	Threshold Criterion	Threshold Criteria Reference
TSP	0.5 mg/m^3	Calculated action level for general dust and particulates
Arsenic	10 $\mu g/m^3$	Cal/OSHA PEL[1]
Lead	50 $\mu g/m^3$	Cal/OSHA PEL
Manganese	200 $\mu g/m^3$	Cal/OSHA PEL
Asbestos	0.1 $fibers/cm^3$	Cal/OSHA PEL
PM_{10}	5,000 $\mu g/m^3$	Cal/OSHA PEL

Notes:

[1] - Cal/OSHA PEL for particulates not otherwise regulated (respiratory) used for PM_{10}
Cal/OSHA = California Division of Occupational Safety and Health Administration
cm^3 = cubic centimeter
mg/m^3 = milligrams per cubic meter
NIOSH = National Institute of Occupational Safety and Health
PEL = permissible exposure limit
PM_{10} = particulate matter less than 10 microns in diameter
TSP = total suspended particulates
$\mu g/m^3$ = micrograms per cubic meter

Table 1-1
Ambient Pressure and Temperature Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Ambient Pressure (in Hg)	Ambient Temperature (°F)
2/19/2013	29.94	66
2/20/2013	29.95	73
2/21/2013	30.06	72
2/22/2013	30.15	73
2/25/2013	30.16	71
2/26/2013	30.11	73
2/27/2013	30.26	74
2/28/2013	30.35	71
3/1/2013	30.32	76
3/4/2013	30.05	64
3/5/2013	29.97	62
3/6/2013	29.96	62
3/7/2013	29.89	61
3/8/2013	29.94	65
3/11/2013	30.16	75
3/12/2013	30.06	78
3/22/2013	30.11	56
3/27/2013	29.99	57
4/9/2013	30.07	59
4/15/2013	29.93	57

Notes:
°F = degrees Fareheit
in Hg = inches of mercury
Ambient pressure and ambient temperature data were gathered from the wunderground weather website (www.wunderground.com). Data were collected from station KCASANFR58.

Table 1-2
Total Suspended Particulates and Metals Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Volume of Air Pumped meters^3	TSP (mg/m^3)	TSP Exceedance? (Yes/No)	Arsenic (µg/m^3)	Arsenic Exceedance? (Yes/No)	Lead (µg/m^3)	Lead Exceedance? (Yes/No)	Manganese (µg/m^3)	Manganese Exceedance? (Yes/No)
2/21/2013	1B	1,444	0.164	No	0.0010	No	0.0194	No	0.0970	No
2/21/2013	2B	1,422	0.042	No	0.0008	No	0.0069	No	0.0218	No
2/26/2013	1B	1,703	0.138	No	0.0011	No	0.0153	No	0.0998	No
2/26/2013	2B	1,677	0.031	No	0.0007	No	0.0034	No	0.0137	No
3/4/2013	1B	1,037	0.121	No	0.0014	No	0.0154	No	0.0781	No
3/4/2013	2B	948	0.062	No	0.0014	No	0.0083	No	0.0295	No
3/7/2013	1B	1,425	0.141	No	0.0009	No	0.0147	No	0.0772	No
3/7/2013	2B	1,403	0.032	No	0.6700	No	3.6000	No	0.0100	No
3/12/2013	1B	1,703	0.130	No	0.0011	No	0.0170	No	0.0881	No
3/12/2013	2B	1,750	0.038	No	0.0006	No	0.0049	No	0.0149	No
3/22/2013	1B	1,481	0.097	No	0.0011	No	0.0135	No	0.0655	No
3/22/2013	2B	1,549	0.037	No	0.0008	No	0.0045	No	0.0161	No
3/27/2013	1B	1,629	0.107	No	0.0006	No	0.0147	No	0.0737	No
3/27/2013	2B	1,173	0.051	No	0.0004	No	0.0102	No	0.0290	No
4/9/2013	1B	1,795	0.016	No	0.0004	No	0.0095	No	0.0423	No
4/9/2013	2B	1,185	0.039	No	0.0004	No	0.0080	No	0.0278	No
4/15/2013	1B	1,703	0.114	No	0.0010	No	0.0153	No	0.0646	No
4/15/2013	2B	1,210	0.104	No	0.0010	No	0.0182	No	0.0570	No
Screening Criteria			0.500		10		50		200	

Table 1-2
Total Suspended Particulates and Metals Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Volume of Air Pumped meters^3	TSP (mg/m^3)	TSP Exceedance? (Yes/No)	Arsenic (µg/m^3)	Arsenic Exceedance? (Yes/No)	Lead (µg/m^3)	Lead Exceedance? (Yes/No)	Manganese (µg/m^3)	Manganese Exceedance? (Yes/No)

Notes:
Sample locations are shown on Figure 1.
The threshold criteria are as follows: TSP = 0.5 mg/m^3, arsenic = 10 µg/m^3, lead = 50 µg/m^3, manganese = 200 µg/m^3.
The detection limit for TSP is 0.06 µg/m^3 assuming a minimum sample volume of 1,600 m^3. The detection limits for arsenic, lead, and manganese are 16 ng/m^3 assuming minimum sample volumes of 1.600 m^3.
µg/m^3 - micrograms per cubic meter
mg/m^3 - milligrams per cubic meter
ng/m^3 - nanograms per cubic meter
TSP - total suspended particulates
Samples Analyzed by TestAmerica
The screening levels for TSP is the calculated action level for general dust and particulates
Screening Levels for arsenic, lead, and manganese are based on the Cal/OSHA permissible exposure limit.

Table 1-3
Particulate Matter Smaller than 10 microns in Diameter (PM10) Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Identification	Sample Date	Sample Location	Sampling Period (hours)	Volume of Air Pumped in cubic meters	PM10 ($\mu g/m^3$)	PM10 Exceedance? Yes/No
ARC020713-19-1A	2/21/2013	1A	19.0	1,311	57.9	No
ARC020713-18-1B	2/21/2013	2A	19.75	1,369	17.0	No
ARC020713-16-1A	2/26/2013	1A	25.25	1,742	42.1	No
ARC020713-15-1B	2/26/2013	2A	25.25	1,750	13.3	No
ARC020713-12-1A	3/4/2013	1A	18.75	1,294	37.4	No
ARC020713-14-1B	3/4/2013	2A	20.0	1,386	21.7	No
ARCO20713-10-1A	3/7/2013	1A	21.5	1,484	33.5	No
ARCO20713-13-2A	3/7/2013	2A	21.5	1,490	13.3	No
ARCO20713-2-1A	3/12/2013	1A	21.8	1,501	43.4	No
ARCO20713-4-2A	3/12/2013	2A	24.0	1,777	17.9	No
ARC031713-27-1A	3/22/2013	1A	20.0	1,380	35.8	No
ARC031713-25-2A	3/22/2013	2A	21.8	1,610	17.5	No
ARC030713-31-1A	3/27/2013	1A	22.0	1,518	33.9	No
ARC030713-31-2A	3/27/2013	2A	23.8	1,758	12.4	No
ARC030713-33-1A	4/9/2013	1A	24.3	1,673	16.7	No
ARC030713-36-2A	4/9/2013	2A	24.0	1,777	6.9	No
ARC030713-38-1A	4/15/2013	1A	23.0	1,587	44.5	No
ARC030713-40-2A	4/15/2013	2A	24.5	1,814	27.5	No

Notes:
Sample locations are shown on Figure 1.

The threshold value for PM10 is 5,000 $\mu g/m^3$ based on the Cal/OSHA permissible exposure limit for particulates not otherwise regulated (respiratory) used for PM10.

The detection limit for PM10 is 0.06 $\mu g/m^3$ assuming a minimum sample volume of 1,600 m^3.

$\mu g/m^3$ - micrograms per cubic meter
PM10 - particulate matter smaller than 10 microns in diameter

Samples Analyzed by TestAmerica

Table 1-4
Asbestos Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Sampling Period (hours)	Volume of air pumped in Liters	Asbestos (fibers/cm^3)	Asbestos Exceedance? Yes/No
2/19/2013	CG472322	24	1,728	< 0.001	No
2/19/2013	CG472623	24	1,728	< 0.001	No
2/26/2013	CG472332-1	24	1,656	<0.002	No
2/26/2013	CG472332-2	24	1,836	<0.001	No
3/1/2013	CG-472903-1	24	1,008	< 0.003	No
3/1/2013	CC-472295-2	24	936	< 0.003	No
3/7/2013	CG472292-1	24	1,548	< 0.002	No
3/7/2013	CG472291-2	24	1,386	< 0.002	No
3/12/2013	CG472384-2	24	1,872	< 0.001	No
3/12/2013	CG472354-1	24	1,697	< 0.002	No
3/21/2013	CG-472836-1	24	540	<0.005	No
3/21/2013	CG-472434-2	24	683	<0.004	No
3/27/2013	CG472258-1	24	1,980	<0.001	No
3/27/2013	CG472462-2	24	1,980	<0.001	No
4/9/2013	CG472316-2	24	2,183	< 0.001	No
4/9/2013	CG472354-1	24	2,160	< 0.001	No
4/15/2013	CG-472270-1	24	2,070	< 0.001	No
4/15/2013	CG-472254-2	24	2,205	< 0.001	No
4/19/2013	CG472301-1	24	1,980	< 0.001	No
4/19/2013	CG472328-2	24	1,976	< 0.001	No

Notes:
Sample locations are shown on Figure 1.
The threshold value for asbestos is 0.1 fibers/cm^3 based on the Cal/OSHA permissible exposure limit.
Reporting limit is calculated using a minimum detection limit of 7 fibers/$millimeter^2$.
fibers/cm^3 - fibers per cubic centimeter
Samples Analyzed by EMLab P&K

ARCADIS
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Base Realignment and Closure
Program Management Office West Naval
Facilities Engineering Command

Air Monitoring Summary Report Remedial Action for Parcel G, Hunters Point Naval Shipyard, San Francisco, California

Contract: N62473-11-D-2226, PTO 0002

May 2013

ARCADIS

Ron Goloubow, PG
Principal Geologist

Air Monitoring Summary Report

Remedial Action for Parcel G, Hunters Point Naval Shipyard, San Francisco, California

Prepared for:
Base Realignment and Closure
Program Management Office West Naval
Facilities Engineering Command
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Prepared by:
ARCADIS U.S., Inc.
2000 Powell Street #700
Emeryville, CA 94608

Our Ref.:
CA000776

Date:
May 2013

Figures

Tables

Appendices

Acronyms and Abbreviations

ARCADIS	ARCADIS U.S., Inc.
BRAC	Base Realignment and Closure
DCP	Dust Control Plan
HPNS	Hunters Point Naval Shipyard
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
PM10	particulate matter less than 10 microns in diameter
TSP	total suspended particles
USEPA	U.S. Environmental Protection Agency

1. Introduction

ARCADIS-US, Inc. (herein after referred to as ARCADIS) is providing environmental remediation services to the U.S. Department of the Navy under the Contract: N62473-11-D-2226, PTO 0002. ARCADIS is performing air monitoring at Hunters Point Naval Shipyard (HPNS) in accordance with the Final Dust Control Plan (DCP), included as Appendix D to the Remedial Action Work Plan for Parcel G, Hunters Point Naval Shipyard, San Francisco, California (ARCADIS 2012). The DMP described procedures that minimized dust during work activities, and required air monitoring to ensure these procedures were effective. The DMP helped prevent exposure of residents and construction crews to potential airborne chemicals of concern, and dust from the work area.

This document summarizes the perimeter air monitoring data collected and analyzed for this project. This summary report describes the following:

- Where and how air monitoring samples were collected
- What test methods were used to analyze air monitoring samples
- How air monitoring data were evaluated

This summary report also presents the air monitoring test results and compares the results with the established threshold criteria included in the DMP.

2. Monitoring Site Locations

Air monitoring stations were mobilized to collect air samples upwind and downwind of work areas for the duration of the project. The predominant wind direction at HPNS is from the west.

Locations of air monitoring stations and wind direction are shown on Figure 1. Air monitoring was performed to ensure effective dust control. The locations of the air monitoring stations were determined based on the prevailing wind direction and were modified as needed. A windsock was used to show wind direction and atmospheric parameters were checked daily at www.wunderground.com (see Appendix A; Table A-1). Atmospheric data provided by www.wunderground.com was collected from station KCASANFR58. Monitoring stations remained stationary while sampling was conducted. In accordance with the DMP, air monitoring samples are collected on a filter from each air monitoring station that operates for a maximum of 24-hours.

Each monitoring station included three separate sample/filter media for:

1. Total suspended particulates (TSP) and for arsenic, lead, and manganese
2. Particulate matter larger than 10 microns in size (PM10)
3. Asbestos

3. Analytical Methods

TSP, Arsenic, Lead, and Manganese. TSP samples were collected with a high-volume (39 to 60 cubic feet per minute) air sampler in accordance with U.S. Environmental Protection Agency's (EPA's) reference sampling method for TSP, described in Title 40 Code of Federal Regulations (CFR), Part 50; Appendix B. Each sample was collected on a filter over an approximately 24-hour period; the filter was then weighed to determine the amount of TSP collected.

Once the amount of TSP was determined, the sample was analyzed for arsenic, lead, and manganese. Arsenic, lead, and manganese were analyzed using a modified EPA Method 6020 (EPA SW846; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its Updates.) The equipment specifications and sampling procedures used, including the sampling apparatus, filters, equipment accuracy, equipment calibration, and quality assurance checks, all conformed to those specified in the analytical method.

PM10. Air samples were collected and analyzed for PM10 in accordance with EPA's reference sampling method for PM10, described in 40 CFR Part 50, Appendix J. Each sample was collected on a filter over an approximately 24-hour period; the filter was then weighed to evaluate the concentrations of PM10 in ambient air.

Asbestos. Air samples were collected and analyzed for asbestos in accordance with the National Institute for Occupational Safety and Health (NIOSH) Method 7400, in the NIOSH Manual of Analytical Methods (NIOSH 1994). Method 7400 required that samples be collected on three piece cellulose ester filters, which were fitted with conductive cowlings, at a sampling rate of between 0.5 liter per minute (L/min) and 16 L/min.

4. Analysis of Air Monitoring Data

Analytical results from air monitoring samples were compared with the threshold criteria listed in Table 1. Construction activities did not result in the exceedances of the established threshold criteria at any time during project execution.

5. Air Monitoring Results

Weather information (including ambient pressure and temperature data) and air monitoring results are presented in the tables included as Appendix 1.

6. References

NIOSH (National Institute for Occupational Safety and Health). 1994. NIOSH Manual of Analytical Methods, Method 7400. August.

ARCADIS. 2012 Final Work Plan Remedial Action Work Plan for Parcel G, Hunters Point Naval Shipyard, San Francisco, California. December.

Table 1 - Threshold Criteria for Analysis of Air Monitoring Data

Test Parameter	Threshold Criterion	Threshold Criteria Reference
TSP	0.5 mg/m^3	Calculated action level for general dust and particulates
Arsenic	10 $\mu g/m^3$	Cal/OSHA PEL[1]
Lead	50 $\mu g/m^3$	Cal/OSHA PEL
Manganese	200 $\mu g/m^3$	Cal/OSHA PEL
Asbestos	0.1 $fibers/cm^3$	Cal/OSHA PEL
PM_{10}	5,000 $\mu g/m^3$	Cal/OSHA PEL

Notes:

[1] - Cal/OSHA PEL for particulates not otherwise regulated (respiratory) used for PM_{10}
Cal/OSHA = California Division of Occupational Safety and Health Administration
cm^3 = cubic centimeter
mg/m^3 = milligrams per cubic meter
NIOSH = National Institute of Occupational Safety and Health
PEL = permissible exposure limit
PM_{10} = particulate matter less than 10 microns in diameter
TSP = total suspended particulates
$\mu g/m^3$ = micrograms per cubic meter

ALT. FIRE HYDRANT

PREVAILING WIND DIRECTION

FIRE HYDRANT

401 402 302 436 435 303 304 420 437 419 424 418 404 363 417 366 407 411 351 415 323 439 324 D-A

LEGEND

PARCEL G BOUNDARY

EXISTING AGGREGATE DRAINAGE SWALE WITH FLOW DIRECTION

EXISTING RAILROAD TRACKS

411 EXISTING BUILDING PAD AND FORMER BUILDING NUMBER

AIR SAMPLING STATION

WINDSOCK LOCATION

NOTE:

UPWIND AND DOWNWIND AIR SAMPLING STATIONS MAY BE RELOCATED BASED ON CHANGES IN THE DIRECTION OF PREVAILING WINDS ON PARCEL G AS INDICATED BY THE ON SITE WINDSOCK.

WIND DIRECTION: PER SOUTHWEST NAVAL FACILITIES ENGINEERING COMMAND WIND ROSE PLOTS OF HUNTERS POINT SHIPYARD 08/06/00-10/12/00

0 150' 300'

GRAPHICAL SCALE

NAVAL BASE REALIGNMENT AND CLOSURE PROGRAM
SAN FRANCISCO, CALIFORNIA

PARCEL G, HUNTERS POINT NAVAL SHIPYARD DUST CONTROL PLAN

REAL-TIME AIR MONITORING

ARCADIS

FIGURE 1

Air Monitoring Results

Table 1-1
Ambient Pressure and Temperature Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Ambient Pressure (in Hg)	Ambient Temperature (°F)
2/19/2013	29.94	66
2/20/2013	29.95	73
2/21/2013	30.06	72
2/22/2013	30.15	73
2/25/2013	30.16	71
2/26/2013	30.11	73
2/27/2013	30.26	74
2/28/2013	30.35	71
3/1/2013	30.32	76
3/4/2013	30.05	64
3/5/2013	29.97	62
3/6/2013	29.96	62
3/7/2013	29.89	61
3/8/2013	29.94	65
3/11/2013	30.16	75
3/12/2013	30.06	78
3/22/2013	30.11	56
3/27/2013	29.99	57
4/9/2013	30.07	59
4/15/2013	29.97	51
4/19/2013	30.25	60
4/24/2013	29.96	54
4/30/2013	29.87	61
5/3/2013	30.08	68
5/9/2013	30.20	56

Notes:
°F = degrees Fareheit
in Hg = inches of mercury
Ambient pressure and ambient temperature data were gathered from the wunderground weather website (www.wunderground.com). Data were collected from station KCASANFR58.

Table 1-2
Total Suspended Particulates and Metals Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Volume of Air Pumped meters^3	TSP (mg/m^3)	TSP Exceedance? (Yes/No)	Arsenic (µg/m^3)	Arsenic Exceedance? (Yes/No)	Lead (µg/m^3)	Lead Exceedance? (Yes/No)	Manganese (µg/m^3)	Manganese Exceedance? (Yes/No)
2/21/2013	1B	1,444	0.164	No	0.0010	No	0.0194	No	0.0970	No
2/21/2013	2B	1,422	0.042	No	0.0008	No	0.0069	No	0.0218	No
2/26/2013	1B	1,703	0.138	No	0.0011	No	0.0153	No	0.0998	No
2/26/2013	2B	1,677	0.031	No	0.0007	No	0.0034	No	0.0137	No
3/4/2013	1B	1,037	0.121	No	0.0014	No	0.0154	No	0.0781	No
3/4/2013	2B	948	0.062	No	0.0014	No	0.0083	No	0.0295	No
3/7/2013	1B	1,425	0.141	No	0.0009	No	0.0147	No	0.0772	No
3/7/2013	2B	1,403	0.032	No	0.6700	No	3.6000	No	0.0100	No
3/12/2013	1B	1,703	0.130	No	0.0011	No	0.0170	No	0.0881	No
3/12/2013	2B	1,750	0.038	No	0.0006	No	0.0049	No	0.0149	No
3/18/2013	1B	1,677	0.103	No	0.0007	No	0.0161	No	0.0775	No
3/18/2013	2B	1,858	0.033	No	0.0003	No	0.4393	No	0.0237	No
3/22/2013	1B	1,481	0.097	No	0.0011	No	0.0135	No	0.0655	No
3/22/2013	2B	1,549	0.037	No	0.0008	No	0.0045	No	0.0161	No
3/27/2013	1B	1,629	0.107	No	0.0006	No	0.0147	No	0.0737	No
3/27/2013	2B	1,173	0.051	No	0.0004	No	0.0102	No	0.0290	No
4/9/2013	1B	1,795	0.016	No	0.0004	No	0.0095	No	0.0423	No
4/9/2013	2B	1,185	0.039	No	0.0004	No	0.0080	No	0.0278	No
4/15/2013	1B	1,703	0.114	No	0.0010	No	0.0153	No	0.0646	No
4/15/2013	2B	1,210	0.104	No	0.0010	No	0.0182	No	0.0570	No
4/19/2013	1B	1,629	0.088	No	0.0004	No	0.0172	No	0.0368	No
4/19/2013	2B	1,132	0.017	No	0.0007	No	0.0300	No	0.0884	No
4/24/2013	1B	1,573	0.228	No	0.0007	No	0.0140	No	0.0502	No
4/24/2013	2B	1,099	0.115	No	0.0008	No	0.1747	No	0.0837	No

Table 1-2
Total Suspended Particulates and Metals Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Volume of Air Pumped meters^3	TSP (mg/m^3)	TSP Exceedance? (Yes/No)	Arsenic (µg/m^3)	Arsenic Exceedance? (Yes/No)	Lead (µg/m^3)	Lead Exceedance? (Yes/No)	Manganese (µg/m^3)	Manganese Exceedance? (Yes/No)
4/30/2013	1B	1,092	0.100	No	0.0023	No	0.0192	No	0.0778	No
4/30/2013	2B	1,111	0.129	No	0.0025	No	0.0216	No	0.0990	No
5/3/2013	1B	1,589	0.133	No	0.0008	No	0.0157	No	0.0818	No
5/3/2013	2B	1,630	0.101	No	<0.0015	No	<0.0007	No	<0.0007	No
5/9/2013	1B	1,989	0.110	No	0.0007	No	0.0151	No	0.0704	No
5/9/2013	2B	2,039	0.080	No	0.0005	No	0.0177	No	0.0589	No
Screening Criteria			0.500		10		50		200	

Table 1-2
Total Suspended Particulates and Metals Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Volume of Air Pumped meters^3	TSP (mg/m^3)	TSP Exceedance? (Yes/No)	Arsenic (µg/m^3)	Arsenic Exceedance? (Yes/No)	Lead (µg/m^3)	Lead Exceedance? (Yes/No)	Manganese (µg/m^3)	Manganese Exceedance? (Yes/No)

Notes:
Sample locations are shown on Figure 1.
The threshold criteria are as follows: TSP = 0.5 mg/m^3, arsenic = 10 µg/m^3, lead = 50 µg/m^3, manganese = 200 µg/m^3.
The detection limit for TSP is 0.06 µg/m^3 assuming a minimum sample volume of 1,600 m^3. The detection limits for arsenic, lead, and manganese are 16 ng/m^3 assuming minimum sample volumes of 1.600 m^3.
µg/m^3 - micrograms per cubic meter
mg/m^3 - milligrams per cubic meter
ng/m^3 - nanograms per cubic meter
TSP - total suspended particulates
Samples Analyzed by TestAmerica
The screening levels for TSP is the calculated action level for general dust and particulates
Screening Levels for arsenic, lead, and manganese are based on the Cal/OSHA permissible exposure limit.

Table 1-3
Particulate Matter Smaller than 10 microns in Diameter (PM10) Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Identification	Sample Date	Sample Location	Sampling Period (hours)	Volume of Air Pumped in cubic meters	PM10 ($\mu g/m^3$)	PM10 Exceedance? Yes/No
ARC020713-19-1A	2/21/2013	1A	19.0	1,311	57.9	No
ARC020713-18-1B	2/21/2013	2A	19.75	1,369	17.0	No
ARC020713-16-1A	2/26/2013	1A	25.25	1,742	42.1	No
ARC020713-15-1B	2/26/2013	2A	25.25	1,750	13.3	No
ARC020713-12-1A	3/4/2013	1A	18.75	1,294	37.4	No
ARC020713-14-1B	3/4/2013	2A	20.0	1,386	21.7	No
ARCO20713-10-1A	3/7/2013	1A	21.5	1,484	33.5	No
ARCO20713-13-2A	3/7/2013	2A	21.5	1,490	13.3	No
ARCO20713-2-1A	3/12/2013	1A	21.8	1,501	43.4	No
ARCO20713-4-2A	3/12/2013	2A	24.0	1,777	17.9	No
ARC030713-23-1A	3/18/2013	1A	20.3	1,397	37.9	No
ARC030713-22-2A	3/18/2013	2A	21.5	1,592	19.2	No
ARC031713-27-1A	3/22/2013	1A	20.0	1,380	35.8	No
ARC031713-25-2A	3/22/2013	2A	21.8	1,610	17.5	No
ARC030713-31-1A	3/27/2013	1A	22.0	1,518	33.9	No
ARC030713-31-2A	3/27/2013	2A	23.8	1,758	12.4	No
ARC030713-33-1A	4/9/2013	1A	24.3	1,673	16.7	No
ARC030713-36-2A	4/9/2013	2A	24.0	1,777	6.9	No
ARC030713-38-1A	4/15/2013	1A	23.0	1,587	44.5	No
ARC030713-40-2A	4/15/2013	2A	24.5	1,814	27.5	No
ARC030713-35-1A	4/19/2013	1A	22.0	1,518	32.7	No
ARC030713-43-2A	4/19/2013	2A	21.8	1,610	11.9	No
ARC030713-47-2A	4/24/2013	1A	21.3	1,466	30.0	No
ARC030713-48-2B	4/24/2013	2A	22.3	1,647	76.8	No
ARC30713-51-1A	4/30/2013	1A	14.8	1,018	36.4	No
ARC30713-50-2A	4/30/2013	2A	22.5	1,666	23.1	No
ARC030713-53-1A	5/3/2013	1A	21.5	1,481	50.8	No
ARC030713-55-2A	5/3/2013	2A	22.0	1,519	38.2	No
ARC 041713-57-1A	5/9/2013	1A	26.9	1,854	34.2	No

Table 1-3
Particulate Matter Smaller than 10 microns in Diameter (PM10) Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Identification	Sample Date	Sample Location	Sampling Period (hours)	Volume of Air Pumped in cubic meters	PM10 ($\mu g/m^3$)	PM10 Exceedance? Yes/No
ARC041713-59-2A	5/9/2013	2A	27.5	1,900	28.3	No

Notes:
Sample locations are shown on Figure 1.

The threshold value for PM10 is 5,000 $\mu g/m^3$ based on the Cal/OSHA permissible exposure limit for particulates not otherwise regulated (respiratory) used for PM10.

The detection limit for PM10 is 0.06 $\mu g/m^3$ assuming a minimum sample volume of 1,600 m^3.
$\mu g/m^3$ - micrograms per cubic meter
PM10 - particulate matter smaller than 10 microns in diameter
Samples Analyzed by TestAmerica

Table 1-4
Asbestos Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Sampling Period (hours)	Volume of air pumped in Liters	Asbestos (fibers/cm^3)	Asbestos Exceedance? Yes/No
2/19/2013	CG472322	24	1,728	< 0.001	No
2/19/2013	CG472623	24	1,728	< 0.001	No
2/26/2013	CG472332-1	24	1,656	<0.002	No
2/26/2013	CG472332-2	24	1,836	<0.001	No
3/1/2013	CG-472903-1	24	1,008	< 0.003	No
3/1/2013	CC-472295-2	24	936	< 0.003	No
3/7/2013	CG472292-1	24	1,548	< 0.002	No
3/7/2013	CG472291-2	24	1,386	< 0.002	No
3/12/2013	CG472384-2	24	1,872	< 0.001	No
3/12/2013	CG472354-1	24	1,697	< 0.002	No
3/21/2013	CG-472836-1	24	540	<0.005	No
3/21/2013	CG-472434-2	24	683	<0.004	No
3/27/2013	CG472258-1	24	1,980	<0.001	No
3/27/2013	CG472462-2	24	1,980	<0.001	No
4/9/2013	CG472316-2	24	2,183	< 0.001	No
4/9/2013	CG472354-1	24	2,160	< 0.001	No
4/15/2013	CG-472270-1	24	2,070	< 0.001	No
4/15/2013	CG-472254-2	24	2,205	< 0.001	No
4/19/2013	CG472301-1	24	1,980	< 0.001	No
4/19/2013	CG472328-2	24	1,976	< 0.001	No
4/24/2013	CG472276-1	27.25	2,453	<0.001	No
4/24/2013	CG472353-2	28.25	2,543	<0.001	No
4/29/2013	CG-472278-1	14.75	1,328	<0.002	No
4/29/2013	CG-472326-2	22.5	2,025	<0.001	No
5/3/2013	CG472306-1	21.47	1,932	0.003	No
5/3/2013	CG472309-2	22.02	1,982	0.002	No
5/8/2013	CG472289-1	26.87	2,418	< 0.001	No
5/8/2013	CG472250-2	27.53	2,478	< 0.001	No

Notes:
Sample locations are shown on Figure 1.
The threshold value for asbestos is 0.1 fibers/cm^3 based on the Cal/OSHA permissible exposure limit.
Reporting limit is calculated using a minimum detection limit of 7 fibers/millimeter^2.

Table 1-4
Asbestos Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Sampling Period (hours)	Volume of air pumped in Liters	Asbestos (fibers/cm^3)	Asbestos Exceedance? Yes/No

fibers/cm^3 - fibers per cubic centimeter
Samples Analyzed by EMLab P&K

ARCADIS
Infrastructure · Water · Environment · Buildings

Imagine the result

Base Realignment and Closure
Program Management Office West Naval
Facilities Engineering Command

Air Monitoring Summary Report Remedial Action for Parcel G, Hunters Point Naval Shipyard, San Francisco, California

Contract: N62473-11-D-2226, PTO 0002

July 2013

ARCADIS

Ron Goloubow, PG
Principal Geologist

Air Monitoring Summary Report

Remedial Action for Parcel G, Hunters Point Naval Shipyard, San Francisco, California

Prepared for:
Base Realignment and Closure
Program Management Office West Naval
Facilities Engineering Command
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Prepared by:
ARCADIS U.S., Inc.
2000 Powell Street #700
Emeryville, CA 94608

Our Ref.:
CA000776

Date:
July 2013

Figures

Tables

Appendices

Acronyms and Abbreviations

ARCADIS	ARCADIS U.S., Inc.
BRAC	Base Realignment and Closure
DCP	Dust Control Plan
HPNS	Hunters Point Naval Shipyard
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
PM10	particulate matter less than 10 microns in diameter
TSP	total suspended particles
USEPA	U.S. Environmental Protection Agency

1. Introduction

ARCADIS-US, Inc. (herein after referred to as ARCADIS) is providing environmental remediation services to the U.S. Department of the Navy under the Contract: N62473-11-D-2226, PTO 0002. ARCADIS is performing air monitoring at Hunters Point Naval Shipyard (HPNS) in accordance with the Final Dust Control Plan (DCP), included as Appendix D to the Remedial Action Work Plan for Parcel G, Hunters Point Naval Shipyard, San Francisco, California (ARCADIS 2012). The DMP described procedures that minimized dust during work activities, and required air monitoring to ensure these procedures were effective. The DMP helped prevent exposure of residents and construction crews to potential airborne chemicals of concern, and dust from the work area.

This document summarizes the perimeter air monitoring data collected and analyzed for this project. This summary report describes the following:

- Where and how air monitoring samples were collected
- What test methods were used to analyze air monitoring samples
- How air monitoring data were evaluated

This summary report also presents the air monitoring test results and compares the results with the established threshold criteria included in the DMP.

2. Monitoring Site Locations

Air monitoring stations were mobilized to collect air samples upwind and downwind of work areas for the duration of the project. The predominant wind direction at HPNS is from the west.

Locations of air monitoring stations and wind direction are shown on Figure 1. Air monitoring was performed to ensure effective dust control. The locations of the air monitoring stations were determined based on the prevailing wind direction and were modified as needed. A windsock was used to show wind direction and atmospheric parameters were checked daily at www.wunderground.com (see Appendix A; Table A-1). Atmospheric data provided by www.wunderground.com was collected from station KCASANFR58. Monitoring stations remained stationary while sampling was conducted. In accordance with the DMP, air monitoring samples are collected on a filter from each air monitoring station that operates for a maximum of 24-hours.

Each monitoring station included three separate sample/filter media for:

1. Total suspended particulates (TSP) and for arsenic, lead, and manganese
2. Particulate matter larger than 10 microns in size (PM10)
3. Asbestos

3. Analytical Methods

TSP, Arsenic, Lead, and Manganese. TSP samples were collected with a high-volume (39 to 60 cubic feet per minute) air sampler in accordance with U.S. Environmental Protection Agency's (EPA's) reference sampling method for TSP, described in Title 40 Code of Federal Regulations (CFR), Part 50; Appendix B. Each sample was collected on a filter over an approximately 24-hour period; the filter was then weighed to determine the amount of TSP collected.

Once the amount of TSP was determined, the sample was analyzed for arsenic, lead, and manganese. Arsenic, lead, and manganese were analyzed using a modified EPA Method 6020 (EPA SW846; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its Updates.) The equipment specifications and sampling procedures used, including the sampling apparatus, filters, equipment accuracy, equipment calibration, and quality assurance checks, all conformed to those specified in the analytical method.

PM10. Air samples were collected and analyzed for PM10 in accordance with EPA's reference sampling method for PM10, described in 40 CFR Part 50, Appendix J. Each sample was collected on a filter over an approximately 24-hour period; the filter was then weighed to evaluate the concentrations of PM10 in ambient air.

Asbestos. Air samples were collected and analyzed for asbestos in accordance with the National Institute for Occupational Safety and Health (NIOSH) Method 7400, in the NIOSH Manual of Analytical Methods (NIOSH 1994). Method 7400 required that samples be collected on three piece cellulose ester filters, which were fitted with conductive cowlings, at a sampling rate of between 0.5 liter per minute (L/min) and 16 L/min.

4. Analysis of Air Monitoring Data

Analytical results from air monitoring samples were compared with the threshold criteria listed in Table 1. Construction activities did not result in the exceedances of the established threshold criteria at any time during project execution.

5. Air Monitoring Results

Weather information (including ambient pressure and temperature data) and air monitoring results are presented in the tables included as Appendix 1.

6. References

NIOSH (National Institute for Occupational Safety and Health). 1994. NIOSH Manual of Analytical Methods, Method 7400. August.

ARCADIS. 2012 Final Work Plan Remedial Action Work Plan for Parcel G, Hunters Point Naval Shipyard, San Francisco, California. December.

Table 1 - Threshold Criteria for Analysis of Air Monitoring Data

Test Parameter	Threshold Criterion	Threshold Criteria Reference
TSP	0.5 mg/m^3	Calculated action level for general dust and particulates
Arsenic	10 $\mu g/m^3$	Cal/OSHA PEL[1]
Lead	50 $\mu g/m^3$	Cal/OSHA PEL
Manganese	200 $\mu g/m^3$	Cal/OSHA PEL
Asbestos	0.1 $fibers/cm^3$	Cal/OSHA PEL
PM_{10}	5,000 $\mu g/m^3$	Cal/OSHA PEL

Notes:

[1] - Cal/OSHA PEL for particulates not otherwise regulated (respiratory) used for PM_{10}
Cal/OSHA = California Division of Occupational Safety and Health Administration
cm^3 = cubic centimeter
mg/m^3 = milligrams per cubic meter
NIOSH = National Institute of Occupational Safety and Health
PEL = permissible exposure limit
PM_{10} = particulate matter less than 10 microns in diameter
TSP = total suspended particulates
$\mu g/m^3$ = micrograms per cubic meter

ALT. FIRE HYDRANT

PREVAILING WIND DIRECTION

FIRE HYDRANT

401 402 302 436 435 303 304 420 437 419 424 418 404 363 417 366 407 411 351 415 323 439 324 D-A

LEGEND

PARCEL G BOUNDARY

EXISTING AGGREGATE DRAINAGE SWALE WITH FLOW DIRECTION

EXISTING RAILROAD TRACKS

411 EXISTING BUILDING PAD AND FORMER BUILDING NUMBER

AIR SAMPLING STATION

WINDSOCK LOCATION

NOTE:

UPWIND AND DOWNWIND AIR SAMPLING STATIONS MAY BE RELOCATED BASED ON CHANGES IN THE DIRECTION OF PREVAILING WINDS ON PARCEL G AS INDICATED BY THE ON SITE WINDSOCK.

WIND DIRECTION: PER SOUTHWEST NAVAL FACILITIES ENGINEERING COMMAND WIND ROSE PLOTS OF HUNTERS POINT SHIPYARD 08/06/00-10/12/00

0 150' 300'

GRAPHICAL SCALE

NAVAL BASE REALIGNMENT AND CLOSURE PROGRAM
SAN FRANCISCO, CALIFORNIA

PARCEL G, HUNTERS POINT NAVAL SHIPYARD DUST CONTROL PLAN

REAL-TIME AIR MONITORING

ARCADIS

FIGURE 1

Air Monitoring Results

Table 1-1
Ambient Pressure and Temperature Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Ambient Pressure (in Hg)	Ambient Temperature (°F)
2/19/2013	29.94	66
2/20/2013	29.95	73
2/21/2013	30.06	72
2/22/2013	30.15	73
2/25/2013	30.16	71
2/26/2013	30.11	73
2/27/2013	30.26	74
2/28/2013	30.35	71
3/1/2013	30.32	76
3/4/2013	30.05	64
3/5/2013	29.97	62
3/6/2013	29.96	62
3/7/2013	29.89	61
3/8/2013	29.94	65
3/11/2013	30.16	75
3/12/2013	30.06	78
3/22/2013	30.11	56
3/27/2013	29.99	57
4/9/2013	30.07	59
4/15/2013	29.97	51
4/19/2013	30.25	60
4/24/2013	29.96	54
4/30/2013	29.87	61
5/3/2013	30.08	68
5/9/2013	30.20	56
5/14/2013	30.01	58
5/20/2013	29.93	63
5/24/2013	29.74	58
6/3/2013	29.88	58
6/7/2013	29.77	58

Notes:
°F = degrees Fareheit
in Hg = inches of mercury
Ambient pressure and ambient temperature data were gathered from the wunderground weather website (www.wunderground.com). Data were collected from station KCASANFR58.

Table 1-2
Total Suspended Particulates and Metals Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Volume of Air Pumped meters^3	TSP (mg/m^3)	TSP Exceedance? (Yes/No)	Arsenic (µg/m^3)	Arsenic Exceedance? (Yes/No)	Lead (µg/m^3)	Lead Exceedance? (Yes/No)	Manganese (µg/m^3)	Manganese Exceedance? (Yes/No)
2/21/2013	1B	1,444	0.164	No	0.0010	No	0.0194	No	0.0970	No
2/21/2013	2B	1,422	0.042	No	0.0008	No	0.0069	No	0.0218	No
2/26/2013	1B	1,703	0.138	No	0.0011	No	0.0153	No	0.0998	No
2/26/2013	2B	1,677	0.031	No	0.0007	No	0.0034	No	0.0137	No
3/4/2013	1B	1,037	0.121	No	0.0014	No	0.0154	No	0.0781	No
3/4/2013	2B	948	0.062	No	0.0014	No	0.0083	No	0.0295	No
3/7/2013	1B	1,425	0.141	No	0.0009	No	0.0147	No	0.0772	No
3/7/2013	2B	1,403	0.032	No	0.6700	No	3.6000	No	0.0100	No
3/12/2013	1B	1,703	0.130	No	0.0011	No	0.0170	No	0.0881	No
3/12/2013	2B	1,750	0.038	No	0.0006	No	0.0049	No	0.0149	No
3/18/2013	1B	1,677	0.103	No	0.0007	No	0.0161	No	0.0775	No
3/18/2013	2B	1,858	0.033	No	0.0003	No	0.4393	No	0.0237	No
3/22/2013	1B	1,481	0.097	No	0.0011	No	0.0135	No	0.0655	No
3/22/2013	2B	1,549	0.037	No	0.0008	No	0.0045	No	0.0161	No
3/27/2013	1B	1,629	0.107	No	0.0006	No	0.0147	No	0.0737	No
3/27/2013	2B	1,173	0.051	No	0.0004	No	0.0102	No	0.0290	No
4/9/2013	1B	1,795	0.016	No	0.0004	No	0.0095	No	0.0423	No
4/9/2013	2B	1,185	0.039	No	0.0004	No	0.0080	No	0.0278	No
4/15/2013	1B	1,703	0.114	No	0.0010	No	0.0153	No	0.0646	No
4/15/2013	2B	1,210	0.104	No	0.0010	No	0.0182	No	0.0570	No
4/19/2013	1B	1,629	0.088	No	0.0004	No	0.0172	No	0.0368	No
4/19/2013	2B	1,132	0.017	No	0.0007	No	0.0300	No	0.0884	No
4/24/2013	1B	1,573	0.228	No	0.0007	No	0.0140	No	0.0502	No
4/24/2013	2B	1,099	0.115	No	0.0008	No	0.1747	No	0.0837	No

Table 1-2
Total Suspended Particulates and Metals Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Volume of Air Pumped meters^3	TSP (mg/m^3)	TSP Exceedance? (Yes/No)	Arsenic (µg/m^3)	Arsenic Exceedance? (Yes/No)	Lead (µg/m^3)	Lead Exceedance? (Yes/No)	Manganese (µg/m^3)	Manganese Exceedance? (Yes/No)
4/30/2013	1B	1,092	0.100	No	0.0023	No	0.0192	No	0.0778	No
4/30/2013	2B	1,111	0.129	No	0.0025	No	0.0216	No	0.0990	No
5/3/2013	1B	1,589	0.133	No	0.0008	No	0.0157	No	0.0818	No
5/3/2013	2B	1,630	0.101	No	<0.0015	No	<0.0007	No	<0.0007	No
5/9/2013	1B	1,989	0.110	No	0.0007	No	0.0151	No	0.0704	No
5/9/2013	2B	2,039	0.080	No	0.0005	No	0.0177	No	0.0589	No
5/14/2013	1B	2,150	0.085	No	0.0007	No	0.0140	No	0.0605	No
5/14/2013	2B	2,152	0.062	No	0.0004	No	0.0107	No	0.0465	No
5/20/2013	1B	2,150	0.169	No	0.0011	No	0.0223	No	0.1163	No
5/20/2013	2B	2,152	0.111	No	0.0007	No	0.0163	No	0.0836	No
5/24/2013	1B	1,536	0.126	No	0.0010	No	0.0143	No	0.0716	No
5/24/2013	2B	1,721	0.153	No	0.0013	No	0.0232	No	0.1162	No
6/3/2013	1B	1,834	0.052	No	0.0004	No	0.0147	No	0.0404	No
6/3/2013	2B	1,491	0.043	No	0.0008	No	0.0060	No	0.0188	No
6/7/2013	1B	2,151	0.068	No	0.0005	No	0.0126	No	0.0511	No
6/7/2013	2B	2,152	0.054	No	0.0003	No	0.0084	No	0.0307	No
Screening Criteria			0.500		10		50		200	

Table 1-2
Total Suspended Particulates and Metals Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Volume of Air Pumped meters^3	TSP (mg/m^3)	TSP Exceedance? (Yes/No)	Arsenic (µg/m^3)	Arsenic Exceedance? (Yes/No)	Lead (µg/m^3)	Lead Exceedance? (Yes/No)	Manganese (µg/m^3)	Manganese Exceedance? (Yes/No)

Notes:
Sample locations are shown on Figure 1.
The threshold criteria are as follows: TSP = 0.5 mg/m^3, arsenic = 10 µg/m^3, lead = 50 µg/m^3, manganese = 200 µg/m^3.
The detection limit for TSP is 0.06 µg/m^3 assuming a minimum sample volume of 1,600 m^3. The detection limits for arsenic, lead, and manganese are 16 ng/m^3 assuming minimum sample volumes of 1.600 m^3.
µg/m^3 - micrograms per cubic meter
mg/m^3 - milligrams per cubic meter
ng/m^3 - nanograms per cubic meter
TSP - total suspended particulates
Samples Analyzed by TestAmerica
The screening levels for TSP is the calculated action level for general dust and particulates
Screening Levels for arsenic, lead, and manganese are based on the Cal/OSHA permissible exposure limit.

Table 1-3
Particulate Matter Smaller than 10 microns in Diameter (PM10) Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Identification	Sample Date	Sample Location	Sampling Period (hours)	Volume of Air Pumped in cubic meters	PM10 ($\mu g/m^3$)	PM10 Exceedance? Yes/No
ARC020713-19-1A	2/21/2013	1A	19.0	1,311	57.9	No
ARC020713-18-1B	2/21/2013	2A	19.75	1,369	17.0	No
ARC020713-16-1A	2/26/2013	1A	25.25	1,742	42.1	No
ARC020713-15-1B	2/26/2013	2A	25.25	1,750	13.3	No
ARC020713-12-1A	3/4/2013	1A	18.75	1,294	37.4	No
ARC020713-14-1B	3/4/2013	2A	20.0	1,386	21.7	No
ARCO20713-10-1A	3/7/2013	1A	21.5	1,484	33.5	No
ARCO20713-13-2A	3/7/2013	2A	21.5	1,490	13.3	No
ARCO20713-2-1A	3/12/2013	1A	21.8	1,501	43.4	No
ARCO20713-4-2A	3/12/2013	2A	24.0	1,777	17.9	No
ARC030713-23-1A	3/18/2013	1A	20.3	1,397	37.9	No
ARC030713-22-2A	3/18/2013	2A	21.5	1,592	19.2	No
ARC031713-27-1A	3/22/2013	1A	20.0	1,380	35.8	No
ARC031713-25-2A	3/22/2013	2A	21.8	1,610	17.5	No
ARC030713-31-1A	3/27/2013	1A	22.0	1,518	33.9	No
ARC030713-31-2A	3/27/2013	2A	23.8	1,758	12.4	No
ARC030713-33-1A	4/9/2013	1A	24.3	1,673	16.7	No
ARC030713-36-2A	4/9/2013	2A	24.0	1,777	6.9	No
ARC030713-38-1A	4/15/2013	1A	23.0	1,587	44.5	No
ARC030713-40-2A	4/15/2013	2A	24.5	1,814	27.5	No
ARC030713-35-1A	4/19/2013	1A	22.0	1,518	32.7	No
ARC030713-43-2A	4/19/2013	2A	21.8	1,610	11.9	No
ARC030713-47-2A	4/24/2013	1A	21.3	1,466	30.0	No
ARC030713-48-2B	4/24/2013	2A	22.3	1,647	76.8	No
ARC30713-51-1A	4/30/2013	1A	14.8	1,018	36.4	No
ARC30713-50-2A	4/30/2013	2A	22.5	1,666	23.1	No
ARC030713-53-1A	5/3/2013	1A	21.5	1,481	50.8	No
ARC030713-55-2A	5/3/2013	2A	22.0	1,519	38.2	No
ARC 041713-57-1A	5/9/2013	1A	26.9	1,854	34.2	No

Table 1-3
Particulate Matter Smaller than 10 microns in Diameter (PM10) Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Identification	Sample Date	Sample Location	Sampling Period (hours)	Volume of Air Pumped in cubic meters	PM10 ($\mu g/m^3$)	PM10 Exceedance? Yes/No
ARC041713-59-2A	5/9/2013	2A	27.5	1,900	28.3	No
ARC 041713-64-1A	5/14/2013	1A	21.6	1,490	34.4	No
ARC041713-59-2A	5/14/2013	2A	23.7	1,634	22.8	No
ARC 041713-64-1A	5/20/2013	1A	25.5	1,762	70.8	No
ARC041713-59-2A	5/20/2013	2A	27.2	1,875	40.4	No
ARC 041713-69-1A	5/24/2013	1A	20.8	1,432	48.0	No
ARC041713-71-2A	5/24/2013	2A	23.3	1,604	56.3	No
ARC 041713-86-1A	6/3/2013	1A	23.2	1,599	31.1	No
ARC 041713-85-2A	6/3/2013	2A	26.6	1,834	34.6	No
ARC 041713-73-1A	6/7/2013	1A	25.1	1,733	22.2	No
ARC 041713-75-2A	6/7/2013	2A	27.8	1,917	14.8	No

Notes:
Sample locations are shown on Figure 1.

The threshold value for PM10 is 5,000 $\mu g/m^3$ based on the Cal/OSHA permissible exposure limit for particulates not otherwise regulated (respiratory) used for PM10.

The detection limit for PM10 is 0.06 $\mu g/m^3$ assuming a minimum sample volume of 1,600 m^3.

$\mu g/m^3$ - micrograms per cubic meter
PM10 - particulate matter smaller than 10 microns in diameter

Samples Analyzed by TestAmerica

Table 1-4
Asbestos Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Sampling Period (hours)	Volume of air pumped in Liters	Asbestos (fibers/cm^3)	Asbestos Exceedance? Yes/No
2/19/2013	CG472322	24	1,728	< 0.001	No
2/19/2013	CG472623	24	1,728	< 0.001	No
2/26/2013	CG472332-1	24	1,656	<0.002	No
2/26/2013	CG472332-2	24	1,836	<0.001	No
3/1/2013	CG-472903-1	24	1,008	< 0.003	No
3/1/2013	CC-472295-2	24	936	< 0.003	No
3/7/2013	CG472292-1	24	1,548	< 0.002	No
3/7/2013	CG472291-2	24	1,386	< 0.002	No
3/12/2013	CG472384-2	24	1,872	< 0.001	No
3/12/2013	CG472354-1	24	1,697	< 0.002	No
3/21/2013	CG-472836-1	24	540	<0.005	No
3/21/2013	CG-472434-2	24	683	<0.004	No
3/27/2013	CG472258-1	24	1,980	<0.001	No
3/27/2013	CG472462-2	24	1,980	<0.001	No
4/9/2013	CG472316-2	24	2,183	< 0.001	No
4/9/2013	CG472354-1	24	2,160	< 0.001	No
4/15/2013	CG-472270-1	24	2,070	< 0.001	No
4/15/2013	CG-472254-2	24	2,205	< 0.001	No
4/19/2013	CG472301-1	24	1,980	< 0.001	No
4/19/2013	CG472328-2	24	1,976	< 0.001	No
4/24/2013	CG472276-1	27.25	2,453	<0.001	No
4/24/2013	CG472353-2	28.25	2,543	<0.001	No
4/29/2013	CG-472278-1	14.75	1,328	<0.002	No
4/29/2013	CG-472326-2	22.5	2,025	<0.001	No
5/3/2013	CG472306-1	21.47	1,932	0.003	No
5/3/2013	CG472309-2	22.02	1,982	0.002	No
5/8/2013	CG472289-1	26.87	2,418	< 0.001	No
5/8/2013	CG472250-2	27.53	2,478	< 0.001	No
5/14/2013	CI968452-1	21.68	1,952	< 0.001	No
5/14/2013	CI968452-2	23.68	2,132	< 0.001	No
5/20/2013	C1968439-1	21.68	2,298	< 0.001	No

Table 1-4
Asbestos Monitoring Results
Hunters Point Naval Shipyard
San Francisco, California

Sample Date	Sample Location	Sampling Period (hours)	Volume of air pumped in Liters	Asbestos (fibers/cm^3)	Asbestos Exceedance? Yes/No
5/20/2013	C1039915-2	23.68	2,445	< 0.001	No
5/24/2013	C1968446-1	20.75	1,880	< 0.001	No
5/24/2013	C1968448-2	23.25	2,120	< 0.001	No
6/3/2013	C1968471-1	24.47	2,229	< 0.001	No
6/3/2013	C1029587-2	26.58	2,393	< 0.001	No
6/7/2013	C1039586-1	25.12	2,261	< 0.001	No
6/7/2013	C1039572-2	27.78	2,501	< 0.001	No

Notes:
Sample locations are shown on Figure 1.
The threshold value for asbestos is 0.1 fibers/cm^3 based on the Cal/OSHA permissible exposure limit.
Reporting limit is calculated using a minimum detection limit of 7 fibers/$millimeter^2$.
fibers/cm^3 - fibers per cubic centimeter
Samples Analyzed by EMLab P&K